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NOTES FOR THE MONTH.

THE Agriculture Bill was presented to the House of Commons just before the Whitsuntide recess, and it is understood that

**The New
Agriculture Bill.**

every effort will be made to secure its passage through both Houses before the present Session ends. The Bill is divided into two parts, the first being, in effect, an amendment of the Corn Production Act of 1917, and the second an amendment of the Agricultural Holdings Acts, 1908 to 1916. The principle of guaranteed minimum prices for wheat and oats is continued, the standard adopted being the one suggested by the Majority Report of the Royal Commission of Agriculture. The prices are to be based upon the following prices for the standard year (1919), namely, 68s. for 504 lb. of wheat, and 46s. for 336 lb. of oats. Three Commissioners are to be appointed, one by the three Agricultural Departments, another by the Treasury, and the third by the Board of Trade, to consider to what extent the cost of production in any given year has varied from the cost in the standard year, and the guaranteed minimum prices for each year will be fixed accordingly. Any payment due will be made after the end of the March following, as under the Corn Production Act. The Corn Production Act is made permanent, except that the guaranteed prices may be terminated by an Order in Council made on an Address presented by both Houses of Parliament,

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but only at the expiration of four years from the date of the Order. This period will be sufficient to enable farmers to re-arrange their crop rotation.

Orders for a change in cultivation can be made only where this is not calculated to injure the persons interested, and they can appeal against an Order to an Arbitrator. Landlords can be required to execute such landlord's repairs as are required to secure proper cultivation, and in case of failure to comply the Minister of Agriculture can authorise the tenant to execute the repairs and recover the cost from the landlord. The latter has a right of appeal against the Order.

From the second part of the Bill the farmer derives additional security against loss by eviction. Any tenant forced by his landlord to leave though not in default, will receive full compensation for all direct loss, together with a sum equal to one year's rent. If notice to quit is given capriciously, or for reasons inconsistent with good estate management, additional compensation up to four years' rent may be given by the Arbitrator. To enable rents to be adjusted without notice to quit, it is provided that if a tenant refuses to arbitrate as to any increase of rent, and the landlord determines the tenancy, the tenant cannot claim for disturbance. If, on the other hand, the tenant asks for a reduction in rent, and in consequence of the landlord's refusing arbitration on the point the tenant gives notice, the tenant may recover compensation for disturbance. Compensation for permanent improvements may be obtained by the tenant, provided that the Agricultural Committee has sanctioned the improvements. In such a case the landlord may elect to make the improvement and charge an additional rent for so doing. The Bill also provides for the application by the Agricultural Committee to a farm, or part of a farm, of the general principles of the Evesham custom for fruit land and market gardens. This custom is for the outgoing tenant to find another tenant to take his place and undertake the liability for compensation, the landlord having to pay the compensation for market garden improvements only if he refuses his outgoing tenant's nominee or gives his tenant notice to quit. Additional compensation is given to a tenant who can prove that he has continuously adopted a specially high standard of farming in excess of that required by his contract of tenancy or by custom. The Bill, with certain modifications, applies to Scotland and Ireland as well as to England and Wales, and it is proposed that it shall come into force on the 1st September next.

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Now that the Agricultural Shows have fully resumed their work after the long interruption of war, there is abundant

**The Advantages of
Agricultural Shows.**

evidence that the organisers of these exhibitions are more than ever alive to the importance of educational exhibits. They realise that it is not sufficient merely to display a good machine or a good article of produce, but that its virtues must be made widely known by attractive demonstrations.

At a number of this year's shows there will be an exhibit illustrating the many-sided work carried on by the Ministry for the improvement of crops and stock, the prevention of disease, the betterment of housing and land drainage, and the general promotion of rural welfare. The Ministry's Exhibit includes specimens of seeds and the methods of seed testing, models of the cottages now being erected on County Council holdings, photographs of plant and animal diseases and land drainage operations, and examples of rural industries, such as basket work and other home handicrafts. At the Ministry's Exhibit visitors may obtain, free of charge, a supply of informative literature, and authoritative leaflets and pamphlets, giving most useful instruction in every branch of agricultural science. Far too few people interested in the land realise the existence of this literature. None should miss the opportunity of visiting the Ministry's Exhibit.

In an increasing measure, Agricultural Shows are disseminating the latest scientific knowledge of agricultural matters. The greatest effort in this direction will be made at the Royal Show, to be held from 29th June to 3rd July at Darlington. The Ministry's Exhibit will be housed in a special pavilion. Other important forthcoming events are the Lincolnshire Show at Grimsby, on 14th, 15th and 16th July; the Royal Lancashire Show at Bolton, from 29th July to 2nd August; and the United Counties at Carmarthen, on 12th August. Later autumn shows will be announced in due course. At all of these the Ministry will be represented.

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AN ounce of practice, the proverb says, is worth a pound of theory, and, following this old maxim, the Ministry has sought to arrange for farmers to carry out on their own fields experiments in the improvement of grass land. The object of these local demonstrations is that farmers and their neighbours, as they go about their

**Improvement of
Grass Land: Local
Demonstrations.**

daily work, may see for themselves what beneficial results arise from the application of the latest scientific methods. The work of providing for these demonstrations was entrusted to the Local Agricultural Education Authorities throughout the country, and although the scheme was initiated only in the middle of January, by the middle of May some 180 demonstrations were actually in progress in 26 out of the 46 counties of England, while arrangements were being made for similar experiments in a further 9 counties. The remaining 11 counties will, it is hoped, shortly take similar action. The scheme is also being carried out in Wales, and, of course, most of the Agricultural Colleges are conducting experiments on grass land. The fields where the experiments are carried out lie in prominent positions, and by next autumn it is hoped that the gains resulting from the treatment of the grass will be able to be judged by local farmers and passers-by who can look upon the fields with an intelligent eye. These practical object lessons are reinforced by a series of lectures delivered by the most eminent authorities on grass-land problems in the country.

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THE Acreage and Live Stock Returns for 1919, just issued by the Ministry, review the general position in recent years, and

**Acreage and Live
Stock Returns.**

special reference is made to the recovery in the arable area resulting from the Government policy of breaking up grass land for food production. For the 40 years previous to 1915, a regular feature of the Returns had been, with few exceptions, a decline in the arable area, but between 1915 and 1918 no less than 1,400,000 additional acres were put under the plough; that is to say, in the short period of three years, the entire loss recorded in the 20 preceding years was recovered. In 1918, the actual proportion of land under the plough was slightly larger than it was in 1898, being 46 per cent. of the total area under crops and grass, as compared with 45 per cent. 20 years earlier. In the same period, the total area under crops and grass decreased to 600,000 acres, owing chiefly to the absorption of land for residential and industrial purposes. This fact renders more striking the large increase of arable, as it was only accomplished by breaking up permanent grass to an extent that reduced the area to less than it had been at any time in the preceding 30 years. During this period, however, an additional area of mountain

and heath land, amounting to 550,000 acres, appears to have been brought into use for rough grazing. This practically counter-balanced the decrease in permanent pasture.

It has been sometimes doubted whether the crops from newly-broken land fully justified conversion of permanent grass into arable. Fortunately, it can be shown that although the yields of all the corn crops on the new arable were less on the general average yield of corn crops in England and Wales, they were not appreciably less, except perhaps in the case of barley. As a whole, they compared very favourably with the 10-year average. Potatoes were quite favourable, but this crop was not largely grown on the newly-broken land. When due allowance is made for the unfavourable harvest conditions in September, 1918, the Returns appear fully to justify the plough policy as a means of increasing the Nation's food supply. It is beyond question that the total amount of food obtained from the new arable land saved the importation of several hundred thousand tons of equivalents, and thus set free a corresponding amount of shipping for war service.

As regards the question of Small Holdings, the Returns show the following fluctuations. In 1903, the total number of holdings was 433,000; in 1908 it had fallen to 430,000. In that year, with the passing of the Small Holdings Act, the movement gained ground, and by 1912 the number of holdings had risen to 435,900. At this point development ceased and, remaining almost stationary for 2 years, thereafter declined rapidly, so that between 1913 and 1919 the loss was no less than 19,000. The reasons for this remarkable decline will be found partly in the absorption of small holdings near towns for industrial purposes, but mainly, perhaps, in the conversion into allotments of fields previously returned separately. If the latter explanation of the decline in the number of holdings below 20 acres be correct it means that while the number above one acre in extent has diminished, the total area under cultivation has not in all probability decreased. An apparently alarming feature may therefore, on stricter examination, be viewed with equanimity.

The position regarding live stock in 1919 was fairly favourable for horses. Cows and other cattle were distinctly above pre-war level. Sheep and pigs were both abnormally low. This decline is mainly attributable to the measures which had to be taken to the control and ration the meat supplies.

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As a result of a Conference held in Chicago on 6th and 7th October last, a Report was submitted to the Secretary of Agriculture, recommending that Congress be asked to provide funds for carrying out trials in farm power problems, to be undertaken by the United States Department of Agriculture in co-operation with the State Colleges.

Farm Power Problems.

At the Conference the various interests concerned—farmers and horse breeders; tractor and implement makers; saddlery and feed-producer representatives; workers from farm management, animal husbandry and agricultural engineering departments of the agricultural colleges; and representatives of interested bureaux of the United States Department of Agriculture—were given the opportunity of presenting their views.

It was agreed that the most urgent problem before the American public to-day is how to lower the high cost of living, and that the key to this, in American agriculture, is to be found in increased and more economic production, which would come chiefly through a more efficient utilisation of farm power. The Conference realised that the power problems needing immediate attention were many and complex, and the various interests represented pledged their active co-operation in carrying out the necessary investigations and demonstrations.

A programme of work was drawn up. This included studies of the economic factors, such as farm power requirements for field operations, hauling and other work; animal power; mechanical power; relation of forms of farm power to man labour; and the influence on the farm organisation and operation of the size of the farm, the character of the soil, the intensity of culture, etc.

The Committee appointed by the Department of Agriculture drew up a scheme of investigation under seven heads:—

1. Testing and rating of farm tractors;
2. Determination of the working rating of horses;
3. Measurement of power requirements of machines and implements;
4. Development of practical methods of expanding the power of farm horses;
5. Determination by field studies of the mechanical efficiency of horses as power units;
6. Increasing the economic efficiency of horse and tractor power by the re-adjustment of the size of the farm and the combination of enterprises;
7. Compiling accurate data concerning farm power demands and the relative cost of meeting these demands by the various kinds of power on farms.

1. *Testing and Rating of Farm Tractors.*—This head will cover field and laboratory tests for the purpose of determining the belt or brake horse power and the drawbar horse power, as well as the fuel consumption of the tractor. Tests will be made under varying load conditions, probably at half and full load as rated by the manufacturer and also at the maximum load that can be developed. The tractors will be operated at the speeds recommended by the manufacturer. There will be an endurance test for the purpose of showing any defects that may exist, and also for determining whether the rated load can be secured under conditions of continuous operation. It is proposed to issue a card showing the rating of tractors.

2. *Determining the Working Rating of Horses.*—Under this head it is proposed to make controlled tests to determine the possibilities and limiting factors in relation to the generation of power by horses of different types. When such preliminary work has been so far carried out as to indicate what type of horse is most efficient as a power unit, teams of such types should be studied in adequate numbers at different points to determine the extent to which age, weight, temperament, sex, condition, soundness, climate, topography, overload, speed, and feed affect the efficiency of horses as power units.

3. *Measurement of Power Requirements of Machines and Implements.*—Studies will be carried on to determine the power required to operate the principal types of field and stationary machinery under the varying conditions arising in farming practice. Ploughs and other tillage implements will be operated in connection with a dynamometer, and the power required to pull the given sizes in various kinds of soil and at different depths of tillage will be determined. Stationary machines, such as ensilage cutters, feed grinders, grain separators, etc., will be tested to determine the power that must be delivered to the belt wheel of the machine and the most effective speed of operation.

4. *Development of Practical Methods of expanding the Power of Farm Horses.*—These investigations should have reference to the economy, efficiency, and more complete utilisation of the horse power existing on the farm, including the use of 4-, 6-, and 8-horse teams; to the use of horses in every possible way as auxiliary power units, including the use of hitches; and to the utilisation of large machinery, such as 2- and 3-bottom gang ploughs, double-disk harrows, culti-packers, 2-row cultivators, large mowers, rakes, binders, and hay loaders.

5. *Determination by Field Studies of the Mechanical Efficiency of Horses as Power Units.*—This can be best determined by the application under field conditions of the principles worked out under heads 2 and 4.

6. *Increasing the Economic Efficiency of Horse and Tractor Power by the Re-adjustment of the Size of the Farm and the Combination of Enterprises.*—This head covers the use of the farm data gathered by survey and cost-accounting methods to show the relation of the various forms of farm power to :—

- (a) Total farm profits ;
- (b) Utilisation and distribution of man labour ;
- (c) Peak-load and slack labour demand periods on the farm ;
- (d) Utilisation of the farm area by various combinations of crops ;
- (e) The increase and decrease of the total farm area due to the use of farm power ;
- (f) The establishment and maintenance of live-stock enterprises on the farm.

7. *The Compilation of Accurate Data concerning Farm Power Demands, and the relative Cost of Meeting these by the various Kinds of Power.*—This work will be concerned with power requirements at various seasons for different types of farming. The data collected will show the amount and kind of power used throughout the year, and the cost of performing specific operations by the different forms of power. The cost has a direct influence on the total farm profits, which is the economic basis for the choice of power.

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THE importance of standardisation in agricultural machinery and implements was urged by a number of witnesses who gave

**Standardisation of
Agricultural
Machinery.**

evidence before the Departmental Committee on Agricultural Machinery. It was agreed that a reduction in the diversity of parts and their interchangeability between implements of the same type are much to be desired. The present bewildering variety of ploughs, for example, produced by individual makers, all in turn differing from those of other manufacturers, and with relatively few fittings common to any of them, increases the difficulties of the users and must necessarily add to the cost of production. Progress in the adoption of standardised methods has been made in America, and tractor manufacturers in this country are also devoting attention to the question.

Standardisation is likely to be greatly assisted by the progress of research, but good will on the part of the various manufacturing interests concerned should accomplish a great deal in the immediate future. Each section of the industry would clearly require to be considered separately, and the prospects of effective work would be found more favourable in some cases than in others. Ploughs and other implements of cultivation appear to afford considerable possibilities of standardisation. The question is one which could no doubt suitably be considered by a Research Association either of the whole trade or any of its sections. The active assistance of the British Engineering Standards Association is assured in advance.

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THE Eastern Counties are fortunate in having agricultural demonstrations brought, as it were, to their very door, by the energy and enterprise of the Great

**The Great Eastern
Railway Demonstra-
tion Train.**

Eastern Railway. This Company has now inaugurated its Demonstration Train, which is, in effect, a mobile exhibition of the most approved methods of poultry rearing, rabbit breeding for fur, beekeeping and general horticulture, applicable to small holders and fruit growers. The train, it is interesting to know, was originally used in the War Hospital Service. In the horticultural coach is an exhibit representing fruit and allotment culture, plant diseases, and fruit and vegetable preservation. Methods of grafting and pruning, photographs of fruit trees, of model allotments, specimens of implements, and the apparatus of bee-culture, are included in the exhibition. Fruit growers, who know only too well how seriously apple-scab, mildew and similar diseases have affected prices of home-grown produce, can here study the various sprays and spraying machines which are so great an aid to the production of clean fruit. Bee-keepers and prospective bee-keepers will be able to handle and examine the latest forms of apparatus, and those specially interested in potatoes can study means of preventing disease. Onion growers will have an opportunity of becoming acquainted with the symptoms of onion-smut, which has lately obtained admittance into England by means of foreign seed. A special exhibit has been arranged to enable cultivators to recognise and cope with this trouble. There is also a display of bottled fruits and vegetables, together with the various types of bottles, cans, ovens and sterilisers. Practical demonstrations of methods and processes will be given from time to time by expert lecturers. Three officers of the Ministry accompany the train.

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CANADA is the birthplace of Women's Institutes. Twenty-two years ago, a little group of countrywomen in Ontario met to discuss the question of lightening the

The Progress of loneliness of their lot on the remote
Women's Institutes. farmsteads. They thought that something could be done to make life better and brighter both for themselves and their children. They met at each other's houses at fixed intervals, not only for social entertainment but also for devising means to secure the various improvements their homes and the district required. Thus the Women's Institute came into being.

Very soon the homes and the farms showed what changes could be accomplished through the efforts of an organised band of intelligent women. This example inspired other women, and before long the institute movement had spread through Canada, and thence into the United States. In 1915, it reached Great Britain, by way of Wales, where, in September of that year, at Llanfairpwll, Mrs. Watt, a British Columbian, started the first Women's Institute in Great Britain. Two months later, the first English Institute was formed by Mrs. Watt at Wallisdown, East Dorset. The number of Institutes thereafter rose rapidly, and by April, 1919, there were 885 Women's Institutes in England and Wales. The number has now risen to over 1,600, and will certainly increase, for these centres of industry and recreation are imparting to village life much of the stimulus needed. Towards the close of 1917, the Ministry undertook the propaganda of the movement, and placed the organisation under the control of the Women's Branch of the Food Production Department. In October last, however, the Ministry relinquished control of the movement, and the whole propaganda and Headquarters work of the Institutes is now conducted by the National Federation of Women's Institutes through an Executive Committee selected by the Institutes themselves.

A Women's Institute is a democratic body. The Committee, elected by the members, is representative of all the women in the village who join the Institute. Through the Institute, women in rural districts can demonstrate that life in a village can be at least as attractive and interesting as life in a busy town or city. Local Authorities have more than once recognised the important part performed by Institutes in rural development by consulting them as to the type of house best suited to the district.

During the War, Women's Institutes mainly concerned themselves with the production, preservation and economy

of food. These important activities are being continued, but work is steadily extending in other directions in order to meet local requirements. An Institute helps each woman to realise her individual duty to the community, and encourages every member to give of her best. Thus, the successful jam-maker discloses her secret recipe; the best bread-maker demonstrates the reason for the lightness of her loaves; the expert bee-keeper gives a practical talk on the wonders of the hive; and the student reveals the treasures of local history. It is, indeed, difficult to exhaust the list of all the Institute's activities. It promotes a higher cultivation of field and garden; it encourages pig and goat keeping, cheese making, fruit bottling, toy, hat and basket making, chair caning and co-operative marketing; it organises egg-collecting and communal kitchens. Institute members have also achieved excellent results in fur craft. Several Institutes have cross-bred their own rabbits to obtain skins of the desired colour. The workers cure the skins, from which they manufacture fur gloves and fur-lined slippers of high-grade quality. Weaving, spinning, knitting and needlecraft are also practised. These are only a few of the efforts engaging attention. Home handicraft, which was taken up spontaneously, has become such an important part of the Institute's activities that it now calls for some measure of control in order to achieve the best results. For this reason, an Industries Sub-Committee has been established at Headquarters to promote and co-ordinate this side of the Federation's work. Various considerations prove the necessity of such supervision. Institute workers, in their eagerness to produce, have not invariably taken pains to secure excellence. This defect was accentuated by the abnormal conditions of the war market, which readily absorbed all goods, including those that were not of the best quality. It is now realised, however, that a high standard of workmanship is required. The task facing the National Federation of Women's Institutes is to secure an adequate supply of teachers. The plan adopted is by means of Guilds of Learners in Handicraft. Guild Schools will be established for training teachers in various branches of home industries, and the provision of qualified instructors will be the first step towards raising the standard of work.

In order that each Institute might be fully acquainted with the progress of the movement and with the activities of every other Institute, the Federation Headquarters publishes a monthly magazine, "Home and Country," and in this way

the centres are kept in touch with each other and the movement is popularised. County conferences and exhibitions are also held periodically, while the Third Annual Exhibition held in London last month attracted widespread interest.

Women's Institutes are taking their share in the life of the country. They aim at improving the conditions of rural life by stimulating interest in the agricultural industry, developing co-operative enterprise, encouraging home and local industries, studying home economics, and providing centres for educational and social intercourse as well as for all local activities.

(Notes on Women's Institutes appeared in this *Journal* in January, 1917, p. 966, October, 1918, p. 827, and December, 1919, p. 939.)

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THE Ministry has had under consideration the advisability of increasing the grants payable to bull, boar, and milk-recording societies. Having satisfied itself that the

**Increase in the
Value of the Grants
payable to Societies
under the Live Stock
Scheme.**

amount of present grants is not adequate to secure the provision of good pedigree sires and to encourage the keeping of milk records, it has increased, as from the 1st April, the grant for bulls from £15 to a maximum of £20, the grant for boars from £3 to a maximum of £5, and the milk-recording grant from £2 10s. a herd to £3, except to Societies for their first and second year of operations, when the grant will be £3 10s. a herd.

When the scheme was brought into operation in 1914, the amount of the grant payable to a bull society was fixed at £15, of which £12 was to be paid to the farmer who provided the bull, and the remaining £3 was utilised for defraying the expenses of the society. The subsidy for a boar was £3. In 1914 the average price of the bulls provided was £36 and of boars £7, and a subsidy of £12 and £3, respectively, was, therefore, sufficient. At the present time, however, the average price of bulls provided under the scheme is approximately £62 and that of boars £14, and as pedigree stock, feeding stuffs and labour have increased in price very considerably since 1914, there are good grounds for increasing the grants. As from the 1st April, the amount of the grant to societies will, therefore, be one-third of the value of the bull, until the society has been in operation for five years. Thereafter the rate will be one-quarter the value of the bull, subject to a maximum grant in both cases of £20. The full amount of the grant is to be paid

to the bull owner, and any administrative expenses incurred by the society are to be defrayed by subscriptions or levies from the members.

The grant for boars will be at the rate of one-third of the value of the boar, subject to a maximum grant of £5.

The grants made to milk-recording societies are also increased in order to encourage the formation of new societies and to secure the provision of reliable and qualified recorders.

The amount of grant that has been paid in the past has been at the rate of £2 10s. per herd per year, subject to a limit of one-half the expenses of a society, but it is recognised that until farmers have proved the commercial value of keeping milk records they are disinclined to pay a levy of 3s. to 3s. per cow, which is the approximate charge made to members of milk-recording societies. It has, therefore, been decided to increase the grant to a milk-recording society for the first and second year of its operations from £2 10s. to £3 10s. a herd, and subsequently the maximum grant will be a maximum of £3 a herd.

It is hoped that the increase in the grants will remove some of the difficulties that have been experienced in forming new societies, and will lead to a more rapid extension of the Live Stock Scheme during the current year.

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In the investigation of possible control measures for certain seed-borne diseases of cereals that do not yield to the ordinary chemical and hot water seed treatments, dry heat has been found particularly adaptable.

**Seed-borne Diseases
of Cereals: Possible
Control by Dry
Heat.**

Experiments carried out by Mr. D. Atanasoff and Mr. A. G. Johnson, of the University of Wisconsin, are described in the *Journal of Agricultural Research* (Vol. viii., 2nd January, 1920, p. 379). It was first attempted to duplicate Naumov's treatment of 1916, in which cereals were subjected to 60° C. for periods ranging from 24 hours to 3 days. This, it was thought, would also kill, or at least greatly weaken, the fungus mycelium present in the interior of the kernels. It was found difficult to verify his results. Wheat and barley thus treated retained their viability, but so did various fungi that infected the kernels. Following this, higher temperature and longer exposures were tested with rather surprising results. Wheat and barley kernels remained viable even after an exposure to heat ranging from 100° to 110° C. for as long as 45 hours. It was soon found possible by reducing this time to lessen the injury to the seed and yet kill the most persistent parasites.

With the exception of one series, all the experiments were made in a gas-heated sterilising oven, ventilated and kept at a constant temperature. In the first experiment, small lots of infected kernels of Kubanka durum wheat and Chevalier barley were exposed to 100° or 110° C. in the gas oven for 15-hour and 30-hour periods. A series of culture experiments were made on the treated seeds to compare them with the untreated. In most cases, *Gibberella*, *Fusarium*, *Helminthosporium* and *Alternaria* developed from the unheated kernels of wheat and barley, as well as from kernels that were heated for 15 hours. From the kernels heated for 30 hours, however, only two yielded fungus growth.

For the second experiment, various grains were treated in a large electrically-heated drying oven at a temperature of about 100° C. in order to test the effect of 15-hour and 30-hour exposures on germinability. Samples of treated and untreated kernels were then sown in sand in the greenhouse. The results showed that good dry seed of barley, wheat, oats and rye was able to withstand this high temperature up to 30 hours. Previous tests had shown this time and temperature to be fatal even to the persistent parasites.

In the third experiment, only seeds known to be infected with various diseases were used. The temperature averaged 100° C. for 30 hours. Samples of the treated and untreated seeds were sown. The result showed that the barley was not killed and that there was perfect control of the diseases, while the untreated seed was heavily infected.

In a fourth test, wheat, oats and rye were submitted to a temperature of about 100° C., and were found capable of withstanding this severe drying process, though with certain samples the germination was seriously reduced.

Field sowings of all the seed lots of the barley, wheat, rye and oats treated in experiments 3 and 4 were made on an isolated place on the University farm. Care was taken to avoid contamination of seed from any source. The results were, on the whole, satisfactory. Not only could the bacterial blight of barley and oats be controlled by the dry-heat treatment, but there was also a likelihood that it would prove efficient in controlling the "blackchaff" of wheat. Applied to wheat infected with "scab," the treatment also pointed to the possibility of eliminating seed infection. Further, "spot blotch" and "netblotch" in barley were partially eliminated by the treatment, which also diminished the percentage of loose smut infection in both barley and oats.

The experiments, which are being continued, suggest promising possibilities. The data at hand indicate that well-dried barley, wheat, rye and oats of good quality are able to withstand protracted exposures to dry heat at comparatively high temperatures. They also show that seed infections from bacterial blight of barley and oats may both be eliminated by exposing the infected seed to dry heat at temperatures that leave the seed still viable. Finally, it is demonstrated that stripe disease of barley, and *Helminthosporium* blotch of oats, as well as loose smut of barley and smut of oats, are markedly reduced without materially injuring the germination of the seed.

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A REPORT of the potato trials carried out last year by the East Sussex County Council has recently been received by the Ministry. Experiments were made both with regard to the cropping and the cooking qualities of certain well-known varieties of potatoes, and some interesting results were obtained.

**1919 Potato Trials
in East Sussex.**

Cropping tests were carried out at five centres, with the results given below.

At *Hellingly*.—The land was not ideal potato land, but was liberally manured and good crops were obtained.

Variety.	Class of Seed planted.			Crop per Acre. Tons c. qr.		
King George ..	Scotch	..	..	16	3	0
Pioneer ..	..	..	..	—	—	—
Lochar ..	..	..	..	15	14	0
Arran Chief ..	..	..	..	13	15	0
Great Scot ..	..	..	..	13	14	0
Arran Chief ..	Local, once grown from Scotland.	..	..	8	12	0
Templar ..	Scotch	..	..	8	8	0

It will be noted that King George yielded 7 tons 15 cwt. per acre more than did Templar, and that Arran Chief (Scotch seed) gave a yield of 5 tons 3 cwt. per acre more than the locally-grown seed of the same variety.

At *Albourne*.—Similar results were obtained, except that Great Scot gave a slightly better return than Lochar.

At *Pett*.—The plots here were about one-tenth of an acre in area. A subsidiary test was made as to the value of spraying, but owing to the abnormally dry season the advantage obtained

was negligible. When the crops at this centre were weighed, ware, seed and chats were calculated separately, as shown in the table below :—

—	Lochar.	King George	Arran Chief (Sprayed).	Arran Chief (Unsprayed)	Templar.
	Cwt. qr. lb.	Cwt. qr. lb.	Cwt. qr. lb.	Cwt. qr. lb.	Cwt. qr. lb.
Ware ..	13 1 18	13 0 20	11 1 15	11 1 0	5 3 26
Seed ..	2 1 0	1 3 8	3 0 24	3 0 20	2 2 10
Chats ..	0 3 18	0 2 25	0 3 25	0 3 24	1 3 3
Total for Plots.	16 2 8	15 2 25	15 2 8	15 1 16	10 1 11
Total calculated per acre	T. c. qr. 13 15 0	T. c. qr. 13 1 0	T. c. qr. 12 18 2	T. c. qr. 12 15 2	T. c. qr. 8 11 3

The large proportion of small tubers in the Templar variety is worthy of note.

At *Northiam*.—The agricultural organiser reports that the land at this centre was not nearly so uniform throughout as at the other centres. The results were again very similar to those obtained at *Hellingly* (above), but the highest yield was from Arran Chief (13 tons 10 cwt.), followed by Lochar (12 tons), King George (10 tons 5 cwt.) and Great Scot (10 tons).

At *Pewsey*.—The land at this centre was very poor. Three kinds of Arran Chief seed were included in the test, and as the yields varied from only 5 tons 2 cwt. for Lochar to 1 ton 14 cwt. for Arran Chief (local seed, once grown from Scotland) they are not worth full record here.

The results demonstrate that, of the varieties tested, Lochar is the one giving the best yields in East Sussex. The order of merit is (1) Lochar, (2) King George, (3) Arran Chief, (4) Great Scot, (5) Templar, the last named being apparently quite unsuited to the soil throughout the county.

The trials also indicate that in good soil, approximately an extra $4\frac{1}{2}$ tons per acre may be obtained by planting Scotch seed in lieu of that grown locally.

In addition to these cropping tests, the East Sussex County Council arranged for a test of the cooking quality of the above-mentioned varieties, and also of one or two other varieties grown in the county. The test was carried out by the East Sussex School of Domestic Economy at Lewes. The results

are tabulated below, the total marks showing the order in which the varieties were placed in regard to cooking quality. :—

Maximum Marks—5.	Ally.	Arran Chief (Scotch).	King Edward.	King George.	Majestic.	Arran Chief (Local).	Lochar.	Templar.
Boiling	5	5	5	3	5	3	3	3
Steaming	5	5	4	4	4	4	3	3
Baking	4	4	3	5	3	5	5	3
Total	14	14	12	12	12	12	11	9

* * * * *

DURING the last year the Ministry arranged for propaganda work to be carried out by one of their inspectors amongst farmers and potato merchants in Lincolnshire, with a view to making clear their responsibility in relation to the introduction of disease when buying seed potatoes.

Prevention of Wart Disease in Lincolnshire.

The main object of the work, which was carried out with the co-operation of the branches of the National Farmers' Union, was to secure that only those potatoes grown in districts free from wart disease should be introduced into Lincolnshire for planting from outside districts.

The work fell into two parts. The first was interviewing merchants, growers and farmers in the county, who were this season obtaining seed potatoes from Scotland. The chief object of these interviews was to ascertain if the growers and dealers had complied with the Wart Disease of Potatoes (Scottish Seed Potatoes) Order, 1919.* In the event of their not having done so, they were asked to communicate immediately with the Scottish merchant from whom they were obtaining their "seed," and request either to be furnished with the necessary certificate and declaration, or, failing that, with a definite statement in writing from the merchant that he held these documents.

In all cases where the Order had not been complied with, farmers, growers and merchants were asked to communicate the result of their inquiries to a central authority.

Information was also collected as to the usual channels from which Scotch "seed" was obtained, and lists of merchants dealing in Scotch "seed" were procured. A list of the names of Scotch dealers with whom Lincolnshire growers generally

* See this *Journal*, January, 1920, p. 1023.

deal was compiled, and information was also obtained as to the varieties of potatoes chiefly grown in the county. This information, no doubt, will prove of great assistance in future seasons.

As a result of these inquiries, it was ascertained that in very few cases did farmers deal directly with Scotland. Most frequently they obtained the "seed" through a local merchant. It was shown that most of the merchants interviewed had not complied with the Order, nor had the Scotch merchant, except in a few instances, voluntarily offered to supply the certificate and declaration, and in all cases the excuse offered by English merchants was total ignorance of the Order. The Ministry's representative pointed out that the variety "Arran Chief" was, more than any other, susceptible to wart disease, and that extra care should be exercised in obtaining this variety from Scotland. Many interesting particulars were also obtained as to the relative popularity of varieties. For First Earlies, "Eclipse" is by far the most popular. Among the Second, "British Queen" takes first place, and among Main Crops, "King Edward" leads easily. "King Edward" and "Evergood" comprise at least 50 per cent. of the Main Crops grown in the county. Among immune varieties "Majestic" appears to be popular among the growers. "Great Scot" holds the next place, while "Dargill Early" and "Arran Comrade" have been taken up by a considerable number of farmers in the Holland District of Lincolnshire.

The second division of the work consisted in addressing meetings of farmers in different parts of the county. At these meetings, the Ministry's inspector described the disease and pointed out the great danger of infection from "seed" obtained from infected areas and the consequences that would follow an outbreak of wart disease. The lecturer also explained the Wart Disease of Potatoes (Scottish Seed Potatoes) Order, 1919, and all other regulations bearing upon the disease. He described the chief immune varieties of potatoes, and mentioned to seed growers the advantages to be derived from the Ministry's free inspection of their growing crops. At the conclusion of several of the meetings resolutions were passed urging the Ministry of Agriculture to bring in any further regulations it considered necessary in order to safeguard the county against risk of infection from seed potatoes obtained from Scotland.

* * * * *

It has been brought to the notice of the Ministry that there are being put upon the market certain proprietary dressings for seed potatoes which are stated to be effective in preventing the development of "Potato Blight."

**Potato Blight:
Uselessness of Seed
Dressings.**

As this disease is reproduced each season from the mycelium or vegetive threads of the fungus actually within the tissues of the tuber, it is useless to expect any external dressing to kill this mycelium without also injuring the tuber. Moreover, the subsequent epidemic character of the disease is due to the development of spores on the foliage of affected plants. These spores are carried from plant to plant and from field to field. The Ministry, therefore, advises growers to exercise caution.

The only really effective preventive of blight is spraying at the proper season, *i.e.*, in late June or early July, with a good fungicide such as Bordeaux mixture (copper sulphate combined with lime) or Burgundy mixture (copper sulphate combined with washing soda), applications used for many years in the vineyards of the Continent. By the timely use of these dressings the spores of the fungus are prevented from germinating and producing the threads which grow into the tissues of the leaf. Well-sprayed haulms, instead of withering under an attack of blight, remain healthy and green; the crop is increased and the tubers themselves remain free from disease. It should be remembered that even the most careful spraying can never be so complete as to prevent all risk of infection, but it is nevertheless a very efficient safeguard. It should be regarded rather as a means of insurance, which will enable the plant to tide over the time during which it is most liable to infection. This period once well past, the work of tuber formation suffers no check, and the yield is larger than would have been obtained from a crop where the plants had been infected. The accumulated evidence of many years justifies the conclusion that, in an average season, the cost of insurance by spraying is amply repaid by the greater yield of healthy tubers.

Spraying too early is wasteful rather than helpful. With the exception of Devonshire, Cornwall and the neighbouring counties it is not usually necessary to begin spraying until the end of June or the beginning of July.

Further information regarding "Blight" and its prevention will be found in the Ministry of Agriculture's Leaflet No. 23, which may be obtained gratis and post free from the office of the Ministry, 3, St. James's Square, London, S.W. 1.

* * * * *

FRUIT growers and others interested in the preservation of fruits and vegetables, will, it is hoped, welcome a special **Fruit Preserving: educational scheme** inaugurated by the **An Experimental Ministry.** A new building situated in the heart of a fruit-growing district at Campden, Gloucestershire, has been equipped as an Experimental Station, to test, on a commercial basis, researches made in this direction. Home and commercial courses are to be inaugurated for the teaching of economic methods of preservation. A comprehensive syllabus for each course has been arranged.

Students taking the commercial courses at the Station will become familiar with the various processes which preserved fruit and vegetables undergo before being marketed. A distinct advantage is that the operations are on a factory scale. This course should be of great benefit to fruit growers, small holders and others interested.

In connection with the home preservation of fruit and vegetables, fortnightly "home" courses are being arranged for at the same Station.

A syllabus, covering a wide field of practice, has been prepared and can be obtained, free on application to the Ministry of Agriculture and Fisheries, 72, Victoria Street, London, S.W. 1, or to the Secretary of the Ministry of Agriculture's Experimental Station, Campden, Gloucestershire.

* * * * *

FOR some months past experiments in the use of new materials and methods of construction for cottage building have been in progress on the Ministry's **Experimental Cottage Building.** Farm Settlement at Amesbury, Wiltshire. These experiments are now sufficiently advanced for certain particulars and conclusions to be communicated.

To enable public authorities and private individuals interested in housing matters to view the experimental buildings while construction is still in progress, the Ministry has decided to allow visits of inspection on Wednesdays during the next two or three months. On this day, the Building Manager or the Resident Clerk of Works will be in attendance to conduct visitors and explain any matters on which they may desire information. The Amesbury Farm Settlement adjoins Amesbury Station on the Salisbury branch line of the London and South-Western Railway.

Thirty-two cottages, forming part of the general equipment of the estate, are included in the present building scheme. The plans for these have been prepared by the Ministry's

architectural staff, but in the case of five cottages, based on one of these plans, the work is being carried out to the special designs of the Department of Scientific and Industrial Research. Direct labour has been employed for the erection of all the cottages except two, these last being erected under contract on proprietary systems of concrete block construction.

The accommodation provided in the cottages is similar in all cases, consisting of parlour, living-room, scullery, bath-washhouse, larder, fuel store, etc., on the ground floor, with three bedrooms over. Of the 32 cottages, half will be constructed in brick on normal lines, forming a standard of comparison for those built of other materials. The remaining 16, which may be classed as more directly experimental, are as follows :—

1. *Building in Pisé de Terre*.—The work at Amesbury consists of three single and one pair of cottages, all two-floor buildings. The walls of one single cottage are complete, and the structure is being roofed. This is the first two-storied pisé dwelling erected in England. The pair of cottages is in course of construction, and the foundations of the two single cottages have been completed. Experiments with various materials for rendering the external face of pisé walls have also been carried out.
2. *Building in Chalk on various Methods*.—The subsoil at Amesbury is chalk, and experiments with this material comprise :—
 - (a) A cottage with cavity walls, built of blocks made of chalk and cement.
 - (b) A cottage with walls of chalk and cement rammed between shuttering.
 - (c) A cottage with walls of chalk only (chalk pisé) rammed between shuttering.
 - (d) A cottage with walls of chalk and straw (chalk cob) built without shuttering.
3. *Building in Concrete*.—
 - (a) Two concrete block cottages with hollow walls, erected under contract by two proprietary firms, using new types of blocks and methods of construction.
 - (b) A cottage of monolithic reinforced concrete construction.
4. *Building in Timber*.—
 - (a) A pair of timber-framed cottages faced with elm weatherboarding.
 - (b) Two army huts converted into permanent bungalow dwellings. The huts were obtained direct from the contractor's yard, in a new and unused condition, but it would appear that no economy can be obtained by the use of these huts for permanent dwellings.

In all the cottages some interesting features in construction and fittings have been embodied. Experiments have also been made in exploring the practical and economical possibilities of subsidiary processes, on which, during wet weather, less skilled labourers can be kept employed under cover.

* * * * *

THE accompanying photographs illustrate the reclamation work which is being carried out by the Ministry at Wainfleet

**Land Reclamation
at Wainfleet.**

on the northern shore of the Wash. About 290 acres of salt-marsh, which is now submerged periodically, is being enclosed by a bank, as shown in the photographs, and when enclosed will be drained by one or more outfalls passing through the bank. It is expected that the enclosed marsh, when reclaimed, will be worth about £40 per acre, and it is proposed to utilise it in connection with a settlement for ex-service men which adjoins it.

* * * * *

It has been brought to the notice of the Ministry that in some quarters the shortage of basic slag is being attributed to

**Effect of Exports
on Supplies of
Basic Slag.**

the permission of exportation on a large scale. There is no foundation in fact for these reports. Export is prohibited except under licence, and the Board of Trade "Trade and Navigation Accounts" show that in 1919 only 13,699 tons were exported, which amounts to 2½ per cent. of the total quantity ground in that year. Similarly, for the first three months of 1920 the exports only amounted to 1,489 tons, about 1 per cent. of the total production. These percentages are much less than the proportion which manufacturers were entitled to ask for in return for their acceptance of the maximum delivered prices for basic slag in Great Britain. In the interests of agriculture they have, however, decided not to insist upon exporting the whole of the quantity which would have been licensed, with the result that the actual exports cannot be said to have accentuated the shortage of slag in any appreciable degree. Labour and transport trouble and such accidents as the destruction by fire of a steel works must be looked to for an explanation of the farmers' difficulties in obtaining slag; but these are now decreasing, and there should be better supplies for the 1920-1921 season. The prices fixed for ground basic slag during the season 1920-21 are stated on p. 296.

* * * * *

THE Minister of Agriculture, Lord Lee of Fareham, on 18th May received a deputation representative of agricultural

**Farm Labourer's
Wage: Deputation
to Minister of
Agriculture.**

members of the Workers' Union in the Home Counties. The Deputation was introduced by Mr. George Dallas. Lord Lee, in welcoming the deputation, expressed his anxiety that it should be realised that he and the Ministry were equally accessible to any

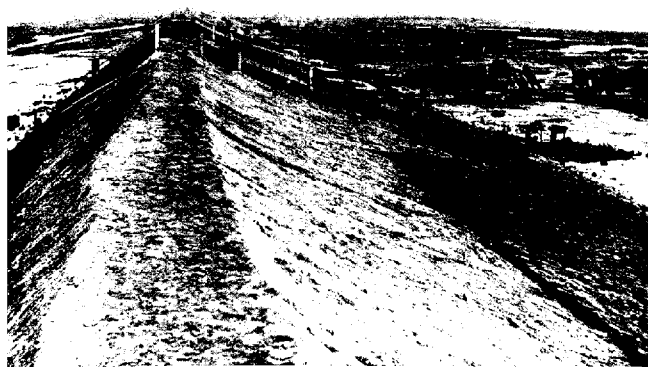


FIG. 1.—New Sea Bank: Wainfleet South. View looking north.



FIG. 2.—New Sea Bank: Wainfleet South. View looking north from junction with new Bystall Bank.



FIG. 3.—New Sea Bank: Wainfleet South. Abandoned work at south extremity of Bank.



FIG. 4.—New Sea Bank: Wainfleet South. View of firmer face of Bank taken from near junction with Bystall Bank.

and all of the classes interested in agriculture. He was specially interested in the general question of the relations between employers and employed in agriculture, because it reacted on the prosperity and output of the industry, and he was always glad to hear the views of all sides. He had no power to intervene, however, in local disputes, or to override in any way the considered decisions of the Agricultural Wages Board.

The deputation emphasised strongly that the wages of agricultural labourers were totally inadequate to meet the present cost of living. Agricultural labourers were a most patient and law-abiding class, but the situation was becoming more serious every day. Ex-soldiers who had returned to work on the land were, not unnaturally, comparing their lot with that of railwaymen, who were living perhaps in the next cottage and receiving £3 a week in addition to many privileges in the way of passes, uniform, etc.

It was urged that the cost of living was greater in the villages than in the towns, and a sample budget was submitted giving the bare necessities for a man, his wife, and four children, which worked out to 47s. 6d. a week. It was clear that an agricultural labourer could not bring up a family on the present minimum wage of 42s. 6d., and if the present position were not remedied the agricultural labourer would "down tools." It was sincerely hoped that a strike would be avoided, but if one took place, it would be a serious thing for the whole community.

Lord Lee, in reply, reminded the deputation that a proposal to increase the minimum wage to 50s. was at present before the Wages Board and would be considered at its next meeting. It was to that Board that their arguments should be addressed. He deplored the existing feeling of distrust between employers and employees, and urged the necessity of a spirit of conciliation on both sides. He had never hesitated to say that the conditions of agricultural labourers must be bettered, and that they should be paid a wage comparable with that of men working under the same rural conditions in other industries. Political pressure was in the direction of putting up wages in all industries, but unfortunately, so far as agriculture was concerned, that same political pressure was demanding cheaper food. It was difficult to render the labour of an industry more expensive and at the same time to cheapen its produce. At present the farmer had two alternative ways of using his land, and if he chose the perfectly legitimate form of grass-farming, with a consequent reduction of the labour he employed, there was

no legal power to stop him, however regrettable such a course might be. The only way to encourage arable farming was to make it more worth while.

Despite the lessons of the War, however, the urban consumer did not yet seem to realise the vital necessity of producing the maximum amount of home-grown food, or to regard the agricultural labourer as much a part of the essential life of the community as the workers in any other industry. Lord Lee pleaded for a better understanding between urban and rural population and for the partnership within the industry itself of labourers, farmers, landowners and everyone concerned with it. He believed firmly in the Wages Board principle of representatives of each side meeting together and trying to arrive at a reasonable agreement, and suggested that the labourers should try to arrange a conference with the Farmers' Union, at which they should support their case by reasons and facts, rather than by threats. Without a willing, prosperous, contented, and vigorous labour on the land, there could be no prosperity for the farming community.

* * * * *

THE Minister of Agriculture is empowered under the Inclosure Acts, 1845 to 1899, to effect exchanges of lands in

**The Inclosure
Acts and Tithe
Acts: Exchanges
of Lands.**

England and Wales. Under these Acts landowners, whether limited or absolute owners, are enabled to avoid the necessity and expense of investigating the titles of the lands exchanged. The leading principles are that the lands exchanged shall be of equal value, and that the land received in exchange shall be held under the same title, and subject to the same uses, trusts, and liabilities, as was the land given in exchange. Upon the confirmation of an order of exchange, therefore, the land received becomes, with certain exceptions, clothed with the title and subject to all the liabilities of the land given up.

It is important to bear in mind that the exchange is made between the two titles and not between the applicants claiming title, who are merely, for the purpose of the exchange, "the persons interested," *i.e.*, generally speaking, the persons in actual possession. These persons may have no title, but nevertheless, provided they are "the persons interested," the exchange is valid as between the persons really entitled, and accordingly it must be such as may properly be made on the assumption that the applicants are not really entitled.

The Minister has no power to authorise a payment of money for equality of exchange. The only provision for compensating a deficiency is by the creation of a perpetual rentcharge, to be charged on the land of greater value, or a sufficient part of it, in favour of that of less value, but such a rentcharge can only be created where the deficiency which requires to be compensated does not exceed one-eighth of the value of the lands which are deficient.

The Minister is also empowered to effect exchanges under the Tithe Acts of glebe for other lands, and also of annual payments belonging to an incumbent in right of his benefice, and charged on lands or tithe rentcharge for lands or for tithe rentcharge. Application for such an exchange may be made by the spiritual person to whom such glebe lands or hereditaments belong in right of his benefice.

The objects and the results of exchanges under the Tithe Acts are similar to those under the Inclosure Acts. There is, however, no provision in the Tithe Acts under which equality of exchange can be effected by the creation of a perpetual rentcharge. The procedure under the Inclosure Acts is somewhat more elaborate than that under the Tithe Acts, and is more suitable for exchanges of large properties, even in cases where the exchange provisions of the Tithe Acts would be applicable.

Forms of application and instructions for exchanges, under either the Inclosure Acts or the Tithe Acts, may be obtained free of charge and post free on application to the General Secretary, Ministry of Agriculture and Fisheries, 3, St. James's Square, S.W. 1.

* * * * *

THE case for the vigorous destruction of rats rests on several considerations. They consume food, they spread infection

Rat Destruction. which is carried by fleas from the rat to human beings, and they are very destructive to buildings, where they gnaw floors and wood-work generally. Both from an economic and a sanitary point of view, therefore, it is highly desirable that these pests should be ruthlessly exterminated.

The destruction of rats is primarily a matter for local effort, and already many County and Borough Authorities, as well as private individuals, have shown praiseworthy energy. Of the 225 Local Authorities which, under the Rats and Mice Destruction) Act, 1919, became responsible for the execution

of this duty, more than 130 have appointed officers to administer the Act. Of these, 31 are special appointments of whole-time officers; to the remainder is entrusted the work of organising and supervising rat destruction in addition to their ordinary duties. The Ministry is in communication with those Authorities which have not yet appointed rat officers, and on these has been urged the necessity for making such appointments as those described. The Ministry also points out that the necessary measures can be organised on lines that are practically self-supporting. No cost falls of necessity on the general body of ratepayers. While substantial progress has been made since the Rats and Mice (Destruction) Act became operative, much yet remains to be done.

One gratifying feature of the work is the fact that the number of rat clubs is increasing. In Kent, the Rat Officer has increased the number of clubs from 14 to 72, representing 101 parishes. He is desirous, however, to see the whole administrative county adequately covered by these organisations. Lindsey, in Lincolnshire, has established 38 rat clubs.

The work done by Bristol during the Third National Rat Week is particularly praiseworthy. The Local Authority of the City applied for and distributed no less than 263,400 rat baits, exclusive of over 5,000 baits laid by the Rat Officer in docks, and 7,500 in sewers. During the same week, Exeter distributed over 6,000 rat baits, and Carmarthen County nearly 1,500, together with 2,500 mouse baits. The bills of rat mortality further include a record of 60,000 rats destroyed during seven months in Nottinghamshire, 18,000 in Dover during the past year, 41,000 in the North Riding of Yorkshire, and 80,000 in Hertfordshire, during a period of four months. In one of the metropolitan boroughs, where it was assumed that the number of rats was negligible, it was found, on investigation, that the borough was overrun. In one factory alone the damage to foodstuffs was estimated at £15 a night. The extent to which the rats thrive on the food they consumed is shown by the fact that some of the carcasses turned the scale at 2 lb. each. In districts where the food supply was not so plentiful, the weight averaged only 8 oz.

A Research Laboratory has now been established by the Ministry with the object of endeavouring to discover rat poisons that are not injurious to domestic animals. The aid of science is also enlisted to improve the poisons already in use.

* * * * *

OCCUPIERS are reminded of their obligations and liabilities under the Rats and Mice (Destruction) Act, 1919. It is important that every care should be taken

**Rats and Mice
(Destruction) Act,
1919: Some Simple
Suggestions.**

to protect ricks, barns, and granaries from the ravages of rats. In urban districts defective drains are a frequent source of rat infestation, while slaughter-houses, bone-yards, refuse dumps, sewage works, and similar places are common breeding places, which should be kept as free as possible from rats by constantly taking measures for their destruction.

Where there is evidence of the presence of rats, the rat officer of the Local Authority, provided one has been appointed, should be consulted, or, if the occupier wishes to undertake destruction himself, one of the poisons containing squills or barium carbonate should be used. If there is no danger to other animals, or to human beings, by the use of stronger poisons, one of the standardised phosphorus preparations is generally efficacious.

To those who may desire to make their own baits, or have them prepared by the local chemist, the following recipes may be tried :—

Recipes for Using Barium Carbonate and Squills.

- | | | | | |
|---------------------|----|----|----|-----------------|
| 1. Barium carbonate | .. | .. | .. | 6 oz. |
| Meal | .. | .. | .. | 16 " |
| Dripping | .. | .. | .. | 4 " |
| Salt | .. | .. | .. | $\frac{1}{2}$ " |

This makes 1,000 baits of 6 grains each (*i.e.*, pieces as large as a hazel nut).

- | | | | | |
|----------------------------|----|----|----|----------|
| 2. Barium | .. | .. | .. | 4 oz. |
| Biscuit meal or plain meal | .. | .. | .. | 4 " |
| Oil of aniseed | .. | .. | .. | 5 drops. |

Mix with fat to a paste, and lay out in pieces the size of a hazel nut in places where rats are known to be present.

- | | | | | |
|------------------|----|----|----|--------------|
| 3. Tallow | .. | .. | .. | 50 per cent. |
| Barium carbonate | .. | .. | .. | 50 " |

Mix with dripping to a thick paste and spread on cubes of bread the size of dice.

- | | | | | |
|--------------------------|----|----|----|--------------|
| 4. Squills, red powdered | .. | .. | .. | 20 per cent. |
| Bread | .. | .. | .. | 30 " |
| Fat | .. | .. | .. | 30 " |
| Syrup | .. | .. | .. | 20 " |
| Aniseed | .. | .. | .. | 6 drops. |

Crumble the bread, mix ingredients to paste and apply as in the case of Nos. 1 and 2.

"Gassing" Rats.—Sulphur dioxide, applied through a Clayton machine or in cylinders, as well as carbon-bisulphide properly applied, can be used to "gas" rats. Calcium carbide

to which water is added to produce acetylene gas, has also been found effective. A simple apparatus for destroying rats by the "gassing" method was described in this *Journal*, March, 1920, p. 1177. A reprint of this note may be obtained gratis and post free on application to the Ministry.

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THE Ministry wishes it to be more generally known that members of the public, on payment of a small fee, may inspect certain documents deposited with the Department. These documents include Apportionments of Tithe Rentcharge, Certificates of Redemption of Tithe Rentcharge and of Corn Rents and other money payments in lieu of tithes; Certificates of Capital Value of Extraordinary Tithe Rentcharge; and Awards of Inclosure and Regulation under the Inclosure Acts, 1845 to 1899. Other documents are Boundary Awards under the Inclosure Acts and the Tithe Acts; Schemes under the Metropolitan Commons Acts, 1866 to 1898; Orders of Exchange, Partition and Division of Intermixed Lands. It is desirable that applicants should, for their own convenience in the first instance write to the Ministry, giving particulars of the document it is proposed to inspect.

In addition to the documents mentioned, the Ordnance Survey Maps of Great Britain and Ireland on the scale of one inch to the mile, and those of Great Britain on the scale of six inches to the mile, may also be consulted. In this case no charge is made for inspection.

The Inspection Room, which is at No. 3, St. James's Square, London, S.W. 1, is open on week-days between the hours of 10 a.m. and 4 p.m., except on Saturday, when it is closed at 1 p.m.

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At the present moment, when the ratio of the cost of feeding to production shows such a small margin, the absolute nutrition

Notes on Poultry Feeding:

From the Harper Adam's Agricultural College.

value of the various foods obtainable, rather than their price, should be the criterion of cost. Price is apt to be deceptive. During the past six months a considerable quantity of excellent poultry wheat has been obtainable at prices lower than, or equal to, mixtures of considerably less feeding value. Although wheat alone would not be a satisfactory feed, in conjunction with a suitably blended mash it should be more economical than the average mixtures at present obtainable, the latter being

for the most part dirty, stale and very expensive in view of their feeding value. Indeed, as matters stand at present it is better to omit mixed grain feeds entirely, and feed separate wheat, oats, and maize, in the ration of 2 : 2 : 1—that is, feeding wheat twice, oats twice, and maize once in every 5 days.

These grains, while being expensive, are likely to prove the most economical grain feeds now available. Samples are available at the following prices per cwt. for small lots, (wholesale prices would, of course, be cheaper) :—Wheat, 20s. ; oats, 23s. ; maize, 25s. At these prices the separate grain feeds are a good deal more economical than the available mixtures.

Turning to the question of mash feeds, at present prices bran, sharps, clover meal, crushed oats and fish meal in the following proportions, 1 : 9 : 2 : 2 : 4, mixed with whatever roots are available, will prove the most economical. Two parts maize meal may be added to the mixture if it is available, but at the present price of 27s. per cwt. it is a dear feed. There is no immediate prospect of food becoming cheaper, and in view of the winter scarcity of green food, clover meal at 12s. per cwt. is worth stocking. Prices for other offal in small lots are, per cwt. :—bran, 16s. ; sharps, 18s. ; crushed oats, 26s. 6d. Taking the year through an attempt should be made to keep the feeding cost down to the price of one egg per week per bird—that is to say, with eggs averaging 4s. per doz., feeding costs should not exceed 4d. per bird per week. This assures financial stability. In this connection the following table of the feeding costs at the Harper Adams Agricultural College Laying Trials may prove interesting, and it will be noticed that the ideal aimed at has not yet been attained. While feeding costs have averaged 4½d. per bird, eggs have only averaged 4d. each. This difference will probably be wiped out when the full 12 months' results are available.

Feeding Cost in Relation to Egg Production (Per Bird),

1919-20.

Month.	Weight of	No. of	Value of	Weight of	Value of
	Eggs.	Eggs.	Eggs.	Food	Food
	oz.		s. d.	lb.	s. d.
1st	16.4	8.4	3 5	6.7	1 5½
2nd	25.7	12.61	5 4½	6.6	1 10
3rd	28.9	14.19	6 0½	6.64	1 3½
4th	36.5	17.74	5 11½	6.54	1 4
5th	40.49	19.85	4 8½	6.62	1 2
5 Months Average	29.59	14.55	5 1	6.62	1 5

* Does not include Vegetables.

With birds on a free range considerable natural food is now available, and a corresponding "cut" can be made in the feeding costs. The amount fed per bird is often a matter of comment. In adult birds it should not exceed 4 oz. per day while laying, though it may be increased to the limit of the birds' appetite during a period of stress such as the moult. It will, however, be found in practice that about 4 oz. represents the maximum required, and this should not be exceeded.

As regards chick feeding, any unwise parsimony is apt to prove very expensive in the long run, and every attempt should be made to keep the young stock growing. Dry chick feeds are at present very expensive, and during the last month have jumped up about 20 per cent.—the price ruling for most samples being about 40s. per cwt. At this price they are too expensive, most of them consisting principally of broken wheat, maize and rice, and a considerable quantity of millet which is apt to be wasted. By far the most economical plan, if the material is available, is to mix the hard feed at home in the following proportions :— Wheat, 8 parts ; rice, 2 parts ; linseed, 1 part ; maize, 2 parts ; dari, 1 part ; millet, 1 part ; but in all probability the material will not be available, or difficulty will be experienced in having it properly kibbled. In this case, kibbled wheat will probably prove the best hard food. Chicks should be fed at least five times a day alternately on grain and mash feeds. A suitable mash can be made of sharps, oatmeal, clover meal and fishmeal in the proportions 8 : 4 : 2 : 1. It should be mixed with sweet separated milk, and a dash of charcoal may be added to each feed. If kibbled wheat only is fed as a dry food an addition can be made to the mash of boiled rice and linseed. The rice and linseed are mixed dry and then boiled or steamed and a small quantity added to each mash feed.

No definite weight of food should be allotted to chicks—care only being taken that no surplus is fed, and that everything is cleared up at each meal and that each chick has a fair share. The actual weight, however, will depend largely on the rate of growth maintained, the weather, etc. ; and the chicks' appetite is by far the best guide.

AGRICULTURE DURING TWO GREAT WARS: 1793-1815 and 1914-18.

THE RIGHT HONOURABLE LORD ERNLE, M.V.O.

ON 18th June, 1815, the long war with France, which, with brief intervals, had lasted since February, 1793, ended at Waterloo. On 11th November, 1918, the Armistice terminated hostilities in another war which had continued for more than four years on a scale that had never been approached or even remotely imagined. It is natural to compare the two great struggles, and to see how far the experiences of the nation a century ago have resembled, or may be expected to resemble, those of to-day and to-morrow. History repeats itself; certain effects more or less invariably result from certain causes. But the main incidence, so to speak, of those results may be shifted by changes in social conditions. Prosperity and plenty, for instance, do not immediately return with the proclamation of Peace. On the contrary, history shows that a period of privation, which in severity and duration depends on the length of the struggle and the degree of financial exhaustion, always follows the cessation of war. But though this law is inexorable, and though some temporary and almost universal hardship is inevitable, the section of the community which suffers most severely is not necessarily always the same.

The causes of the two wars need not be discussed. There is between them one broad resemblance. Whatever may be said of the first stage of the long French War (February, 1793 to March, 1802), the second stage (May, 1803 to June, 1815) sprang from practically the same cause as led to our recent struggle against the Powers of Central Europe in 1914-18. With Bonaparte as first Consul, and afterwards as Emperor, France entered on a war of aggression. Against French domination in Europe the struggle became national. It was the uprising of nations which at length overwhelmed Bonaparte. So, in the recent War, Great Britain was struggling to preserve her independent national existence against the predominance of German autocracy and against gigantic schemes of military conquest and annexation. In both cases she was bound, whatever the cost of life and treasure, to persevere to her last man and her last shilling. But though the cause of both wars was practically identical, their course presents more of contrast than of resemblance. Two instances are enough. In the

French war we had not, and could not have, the gallant and invaluable aid of the overseas Dominions. From 1812 to 1814 the United States, instead of being our allies, were our enemies and at war.

In comparing our position at the two periods striking differences appear. Two points may be specially noted, the growth of our population and the increase in our resources. In 1801 the population of the United Kingdom was about 15,000,000; in 1811 it was about 18,000,000. In 1821, the first year in which Ireland was included in the Census, it was nearly 21,000,000. In 1911 the population of the United Kingdom exceeded 45,000,000, and thanks to their magnificent loyalty, we had, with us and behind us, the vast population of the Empire. Scarcely less striking is the growth of our financial resources. No complete figures exist to show the exact amount of the national income in the early years of the 19th century. But statisticians seem to accept as an approximate estimate a national income of £250,000,000, and it has been calculated that, of this total income, £120,000,000 were above and £130,000,000 below our pre-war Income Tax exemption of £160. Fuller and more reliable figures are available for 1914. There is substantial agreement on the estimate of a national income of rather more than £2,000,000,000, and on a division of this total income into £800,000,000 above, and £1,200,000,000 below, the £160 which was the pre-war limit of exemption from Income Tax. Thus the United Kingdom began the War of 1914 with a population which was three times greater than that of 1801, and with resources which were eight times as large. These two points must be borne in mind, if the national effort and the national burden of the two periods are compared.

Taxation and the National Debt.—When our ancestors entered on the French war (February, 1793) the National Debt amounted to nearly £234,000,000, and the entire public expenditure slightly exceeded £19,000,000. On 5th January, 1816, the Debt had risen in round figures to £864,000,000 and the expenditure of the preceding year exceeded £106,000,000. In April, 1914, the National Debt stood at £665,000,000, and the public expenditure for the year was estimated at £210,000,000. In April, 1919, the Debt had risen to £8,000,000,000, and the public expenditure of this present year is estimated to reach £1,400,000,000. Both in the French and in the German wars a part of the debt was incurred for loans and subsidies to Allies. In 1793–1815 the sum so expended was over £53,000,000; in 1914–18 it was £1,961,000,000. Even allowing for such

assets, the load of new debt was at both periods enormous. No country which is in such a financial position relative to its population and wealth can hope to escape a period of privations more or less severe. Such a period followed the French war. A similar period is bound to succeed the war with Germany. But the nation to-day is far better organised and equipped to distribute the suffering evenly. In the last century experience proved that the only remedy was increased production and economy. To-day, as then, there is no other way out. We must create the new earth before we can inherit the new heaven.

The burden of taxation must to some extent fall on all. But here a significant change has taken place. During the French war more than half the national revenue was raised by Customs and Excise Duties. This part of the burden fell upon consumers because the indirect taxation was levied on many articles of general consumption, such as salt, candles, soap, malt, and leather. A War Property Tax of 2s. in the pound was imposed from which incomes under £200 received graduated relief, and those under £60 a total exemption. Farmers contributed on the basis of profits calculated at three-fourths of their rack rents. Throughout the German war a different policy has been pursued. So far as possible, indirect taxation has been abandoned, and consumers generally have benefited by the relief. Direct taxation has taken its place. It has fallen on the richer sections of the community, who have met more than three-fourths of the current expenditure of the War. The following figures show the proportions of direct and indirect taxation (including excess profits as direct) :—

			<i>Indirect.</i>	<i>Direct.*</i>
			<i>Per cent.</i>	<i>Per cent.</i>
Year to 31st March,	1917..	..	23·7	76·3
"	"	1918..	17·3	82·7
"	"	1919..	20·5	79·5
"	"	1920..	27·96	72·04

Farmers have contributed on the basis of double their rents, with the alternative of paying on their actual profits. Equally significant is the post-war policy of taxation. In 1815 our ancestors abolished the Property Tax, which was the principal form of direct taxation in force during the War. In 1920 no relief is given to the richer sections of the community from direct taxation. On the contrary, the burden is increased and laid on fewer shoulders. This policy is undoubtedly the fairest, because the smaller the income the smaller the margin beyond necessities. But the result is that the man who suffers

most is not the wage-earner. He has a substantial rise in wages but remains below £250, which is to be the limit of exemption from Income Tax. The load falls most heavily on the citizen who cannot increase an income which, though small, is liable to taxation. Between the two millstones of taxation and prices he will be ground "exceeding small." His life will be a struggle against real privations, embittered by the contrast with former comforts and by the use of those pitiful subterfuges that are necessary to maintain appearances.

The different policies pursued in respect of taxation, both during and after the French and the German wars, are significant of a profound change in the spirit of the 20th century. Another illustration of the same change of feeling can be traced throughout the agricultural history of the two periods.

Changes in Agriculture.—During the period 1793–1815 Great Britain was passing from an agricultural to a manufacturing nation. The transition began before the outbreak of war; it continued some years after the peace. A third of the people were still engaged upon the land, and from the land was, in 1814, derived a third of the gross assessments to Income Tax. But the population was rapidly increasing; it was withdrawing from agriculture, and shifting from the South to the coal and iron fields of the North; rural industries hitherto carried on in country cottages were being supplanted by textile machinery, and concentrated in factories. The enthusiasm for agricultural progress which had been steadily growing during the half century before the war, was at its full height. Large farms, large capital, long leases, and the most improved methods of cultivation and stock-breeding were the Gospel of the day. It was practised as well as preached. The division of labour was fast becoming an economic necessity. Agriculture, like manufacture, was ceasing to be a domestic industry. Both had to be placed on a commercial footing.

At any time, the social and industrial changes which were involved must have caused dislocations and required readjustments of existing conditions. Severe hardships were necessary consequences. Under war pressure, not only was the suffering aggravated, but the food problem was complicated. Foreign supplies of corn were obstructed. If any were obtainable, their prices were increased by heavy freights and insurances •which, at war risks, rose from 30s. to 50s. per qr. To our ancestors the provision of bread-stuffs for a growing population, which was fast assuming an urban character, had become

a matter of extreme urgency. Under the tyrannical spur of necessity, great agricultural changes which were already in progress were crowded into the short space of 20 years. It was now that a large proportion of the rural population were severed from the use of the soil. This is not the occasion to discuss the Enclosure Acts which, during the war period, dealt with 4,000,000 acres of wastes and open field farms. Most people looking back on the past will recognise that though the action taken may have been necessary, and, in the majority of cases, legal, the law was often harshly interpreted, and that a golden opportunity was missed. To the community, the social loss was immense. The justification of enclosures lies in the facts that the necessities of the day required factories of bread and meat for the thousands who were gathering in manufacturing centres; that the fullest possible use of the land for the production of food had, owing to the war, suddenly become vital to the national existence; that the farming practices of the self-contained, self-sufficing communities of open-field farmers were a hindrance to this fullest use as well as to industrial development. All this is true. On the other hand, in the moral and social interests of the community, it would have been wise and easy to preserve the independence of the peasant by securing to him the use of a portion of the land.

To our ancestors, struggling in the throes of a great war, the provision of bread was the paramount consideration. Five years ago the present generation could scarcely have understood their position. Recent experience may have helped us to see more clearly with their eyes. What they dreaded was a deficiency of corn. The only foreign supplies that were available to meet a scarcity in our home-grown crop were grown under climatic conditions similar to our own. Harvests were simultaneously favourable or simultaneously unfavourable. If our home crop was short, the crops of Northern Europe were also short. There was no alternative source—for supplies from North America were so small as to be negligible—which was independent of our own adverse seasons. Provision against deficiency was, therefore, an essential feature of the Corn Laws from 1689 to 1815. The scales of regulating prices were frequently revised. But the principles remained the same. In normal years, when home prices kept below a certain level, imports of foreign corn were prohibited. When home harvests were abundant, exports were encouraged by a bounty. If the home crops were deficient, and prices rose above a certain level, exports were

prohibited, and foreign corn was admitted at reduced rates, or even at the ordinary poundage of 4*d.* per qr. It was believed that the system not only steadied prices, but reduced the risk of scarcity by encouraging farmers to maintain a larger corn acreage than in normal years was necessary to feed the population. Whether consumers gained or lost by the arrangement it would be difficult to decide. They were not cut off by Import Duties from any cheaper supply than their own, because from 1689 to 1765 English wheat averaged 4*d.* per qr. less than the price in Continental markets. Foreign corn, bearing the additional cost of freight and insurance, could rarely have reduced the price of English grain. On the other hand, in times of scarcity home consumers benefited by the large acreage under corn which was maintained by the bounty on exportation.

From 1765 onwards, under the pressure of a growing population, England gradually ceased to be an exporting country; in the last 35 years of the century her imports of corn exceeded her exports by over 22,000,000 qr. Throughout the French war the Corn Laws were practically inoperative. Liberty to export was continuously suspended. At the same time exceptional efforts were made to secure imports from abroad. For fear that private buyers might be deterred from buying by high prices, freights and insurances, agents on behalf of the Government shipped corn to this country from the Baltic ports; grain in neutral ships destined for foreign countries, was seized and put on the home market; heavy bounties were offered to importers of wheat.

Yet, in spite of these efforts, and in spite also of the high prices which prevailed in this country during the war, we only succeeded, from 1801 to 1816, in obtaining a yearly average of less than 600,000 qr. of wheat from abroad. For this comparative failure there were many reasons—such as the generally unfavourable seasons and consequently the universal shortage, the ravages of war, competitive buying by belligerent nations, the obstruction of the ports by political, naval or military complications. But the smallness of the figure is a significant proof of the success of farmers at home in meeting the national needs of a growing population. It was estimated in those days that the annual consumption of bread averaged from 8 to 6 bushels of wheat per head of the people. On this reckoning some 600,000 persons were each year throughout the period fed by imported wheat. In 1801, therefore, over 14,000,000 of the people, in 1811 over 17,000,000, and in 1816

over 18,000,000 were supplied—often inadequately, but still supplied—with bread-stuffs produced at home. In 1821, when imports had dwindled to an annual average on the preceding ten years of 450,000 qr., 20,500,000 people were fed from home-grown grain. One other point may be added. The unprecedented heights to which prices from time to time soared have seized on our imaginations and remained in our memories. The falls are forgotten. The following figures of prices afford another proof of the agricultural advance and the increased productiveness of the soil. They show that, when seasons were favourable, farmers, even after 22 years of war and with higher costs of production, could not only feed the people, but fed them with comparative abundance and cheapness:

<i>Date.</i>	<i>Wheat.</i>		<i>Barley.</i>		<i>Oats.</i>	
	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>
1792, December ..	47	2	29	10	18	6
1798, November ..	47	10	29	0	19	10
1804, March ..	49	6	22	9	19	9
1816, January ..	52	6	24	8	18	7

Agriculture and Weather Influences.—One lesson which the course of the war of 1793–1815 might well bring home to consumers is the dependence of the farmer on the weather. For many years past, the nature of the season at home has mattered nothing to the present generation of townsmen. If the home harvest failed, the urban consumer got his bread from a country where it had succeeded. He neither knew nor cared whether the home crop was large or small; the loss fell on farmers, and he was in no way affected. But in the French war every man, woman and child knew what an adverse season meant. There was practically no alternative supply. A severe winter, a cold spring, a wet, sunless summer, even before their effect on the yield of the coming harvest was known, sent prices up and doubled the cost of bread. All England watched the weather as eagerly as the farmer, because between the weather and prices there existed the closest correspondence. It was the character of the season which, in the main, determined the price of the quartern loaf. The intimate connection between the two is hidden from us to-day by the method of recording the average yearly price of corn from 1st January to 31st December. The averages are thus made up as to two-thirds by the results of one season, and as to one-third by the results of another. No one who reads these averages would suppose that 1799, with its relatively low price of 69s., and 1813 with its high price of 109s. 9d., were respectively the worst and the best harvests within living memory.

Throughout the whole war period, seasons were adverse rather than favourable. Fourteen of the 22 were deficient, and, out of that number, eight (1795, 1797, 1799, 1800, 1809—10, 11, 12) were more or less disastrous. Six of the harvests produced average yields. Only two (1796 and 1813) were exceptionally fine and abundant. Bad years caused real scarcity. Twice (1799 and 1812) there was a dearth that almost amounted to famine. It was only in 1813 that the effect of the improved cultivation and increased productiveness of the soil was fully felt. The surplus of the harvest affected prices in the cereal years both of 1814 and 1815.

The Government did not attempt to control prices, or ration food. They probably relied on the high prices to check extravagance in the use of a scanty stock. Instead of cheapening bread by a subsidy from the taxpayer, they subsidised labour through the Poor Law. They not only legislated against trade combinations (1800), but, instead of trying to fix minimum wages, a Committee of Parliament reported (1808) that the proposal was inadmissible in principle, and in 1813 the law empowering justices to fix rates of wages was repealed. But the Government did endeavour to meet the scarcity of bread by some of the other methods with which we have been recently familiar. In 1795, for instance, stocks in hand were known to be short, and only 300,000 qr. of wheat could be obtained from abroad. The winter of 1794-5 had been exceptionally severe. A frost which began in December lasted till the middle of March. A cold, backward spring was succeeded by a wet and stormy summer. Though magnificent harvest weather temporarily raised hopes, the crop proved to be very deficient. The gloomy prospects were referred to in the King's speech of 29th October, 1795. Wheat at Michaelmas, 1795, stood at 92s. per qr.; at the following Lady Day it had risen to 96s.

Official Action during the Napoleonic War.—A Select Committee of the House was appointed to inquire into the scarcity, and measures were taken for its alleviation. By way of example, Members of Parliament bound themselves to reduce consumption in their own houses by one-third. The imposition of the Hair Powder Tax killed the fashion of plastering the head with flour. Bakers were authorised to use other ingredients than corn, provided that bread so mixed was stamped with "M." Privy Councillors and Aldermen tried to set the fashion of eating the coarsest forms of bread. But their efforts were only partially successful. The people clung tenaciously to the finest and whitest wheaten loaf. So severe was the scarcity that some

sections of the community were brought to the verge of famine. A rise in wages, and the distribution of funds raised by private individuals for the benefit of the poor, mitigated the misery.

But it was now that one of the most fatal blunders of the war was committed. The Poor Law was invoked to give relief. The Berkshire magistrates, meeting at Speenhamland, endeavoured to fix a "fair wage" by using the rates to supplement earnings in proportion to the price of bread and the size of the family. Their action, legalised by Parliament in the following year, was imitated by other counties. It was not till after the proclamation of the peace that the evil consequences of this well-meant action stood revealed. For the moment the fine harvest of 1796 restored abundance, and reduced prices, till in 1798 they fell back to their pre-war level. At subsequent critical stages in the food supply of the country further measures were added. Royal proclamations exhorted the people to economy; closer milling was adopted; the sale of bread was prohibited until it was 24 hours old; distilleries and starch manufactories were suspended; rice and maize were brought into the country to mix with corn-flour; potatoes were urged on farmers and their growth encouraged; bounties for the import of corn were continually raised in amount. It is, perhaps, worth recording that during two years of one of the worst periods of scarcity—1809-12—considerable supplies of corn were obtained from France with the consent, apparently, of the French Government.

Agricultural Prosperity in 1763-1815.—The war period was for landowners, tithe-owners, and farmers a time of great prosperity. An enormous capital was spent on the erection of farm buildings, houses and cottages, and on the improvement of the land by reclamation, and by the restoration of fertility to impoverished soils. It was now that, at an immense expenditure of money, much of the agricultural land of the country was, for the first time, made. New areas were forced into productiveness by the sheer weight of the metal poured into them. For the time the expenditure proved remunerative. It is probable that, within the 22 years of the war, rents were doubled, though much of the increase really consisted of interest on the new outlay of capital. In spite of high rents a new class of tenants—men of intelligence, enterprise, and money—were attracted to the land. Secured by long leases, they themselves carried out costly improvements. Land was marled, limed and drained. Whatever the science of the day could teach them was eagerly absorbed. New crops were introduced; new

manures were tried; new machinery and implements were purchased. More stock was kept, and it was both better bred and better fed. Money was made in farming. Both among landowners and farmers the standard of living was raised. Land rose in value. It was eagerly bought at high prices by farmers for their own occupation. Another class of buyers was attracted into the market; the advent of the speculator, or "land jobber" as he was then called, is noted.

Agricultural Labour after the Napoleonic War.—To labourers, who neither owned nor occupied land, the rise in prices brought no compensation. The increased cost of living was not adequately met by a corresponding advance in earnings. Cash wages undoubtedly rose substantially. Whether Arthur Young and Tooke are justified in claiming that they doubled may be doubted. There is some evidence that cash wages rose from 7s. to 12s. 6d. a week; but it is difficult to say with certainty that such a rise was universal. The most that can be said is that, so long as the agricultural activity lasted, there was no lack of employment at considerably enhanced wages. Had labourers still been able to supplement their increased cash earning by the use of land or by their domestic handicrafts, it is possible that, in spite of the high, but fluctuating, prices for food, they might have even bettered their position. But their rural industries were now employing thousands of townsmen in the factories, and the land, where they had gathered firing or run their live stock, was growing corn for the population of manufacturing centres. It was not till the war was over, when wages were falling and unemployment was rife, that the full extent of their irreparable loss was revealed. To landowners and farmers the 20 years that followed the end of the war were a period of falling fortunes and to labourers of misery, and moral degradation. To the whole agricultural community "Peace and Plenty" proved a delusion; to the agricultural labourer it was a cruel mockery.

Agriculture at the Time of the Great War.—During the recent war the story of British agriculture is fresh in our minds. It does not need to be retold. But the position of the industry and the policy adopted towards it at the two periods of the French and German wars are strongly contrasted.

Long before the close of the 19th century, Great Britain had been transformed into a manufacturing country. In the process, for good or for evil, agriculture had been sacrificed. Its interests had been subordinated to those of manufacture. It had dwindled in its relative importance as an income-tax-

paying and labour-employing industry. In 1814 the gross assessment to Property Tax of lands, tithes, manors and fines in Great Britain was little less than one-third of the gross assessments of all sources. In round figures it was £42,500,000 out of £137,500,000. It has stood still while other forms of property have advanced. In 1914 it remained at practically the same figure as it was a century before, while other sources had risen to over £1,000,000,000. Thus agriculture had dropped from one-third to one-twentieth. A similar change has taken place in the proportion of the agricultural population to the rest of the inhabitants. In 1814 a third of the people were agricultural. In 1914 nine-tenths were engaged in other industrial pursuits. Home agriculture no longer holds the same position in regard to the food supplies of the nation as it held in the early part of the 19th century. Its productiveness has declined, and, making every allowance for a higher standard of living, the decrease is probably actual as well as relative. In 1821 it grew the bread-stuffs of more than double the number for whom it provided in 1914. In 1821, also, it supplied the whole of the beef and mutton eaten in the country. Here it has probably made an advance. In 1914 it provided the fresh meat for some 25,000,000 out of a population of 45,000,000; but it largely depended on imports of concentrated feeding stuffs for the support of its live stock. The decline in its power, relative or actual, to pay Income Tax, employ labour, or produce food has been accompanied by a decrease in its political importance. Its influence during the French war may have been as disproportionately great as it is now disproportionately small. Be that as it may, the agricultural interest, which in 1814 was paramount, has lost the greater part of its political power.

Agricultural Policy during the Great War.—These changes in the agricultural industry have been necessarily reflected in the policy adopted towards the industry in the recent war. Agriculture has undoubtedly prospered, but its prosperity has been small as compared with that of the period 1793–1815. Farming profits have been restricted. The incentive of high gains which spurred the agricultural industry to such enormous efforts in the French war were not allowed to operate so fully in the recent struggle. Patriotism made as strong an appeal as the pocket. The great exertions made by home-producers in the face of unexampled difficulties were all the more creditable because, throughout the latter part of the German war, so much more was done for consumers than for

producers. The laws of supply and demand which, in the last 40 years, have been strictly enforced so long as they favoured consumers, have been set aside as soon as they favoured producers. Not unreasonably that has been a sore point with farmers.

Wheat may be taken as an illustration. In the French war prices found their natural level. They soared in years of deficiency; they fell in years of abundance. Farmers were compensated for the fall by the larger quantity which they had to sell. In the German war a flat maximum price was fixed which did not vary with the seasons. Whether the yield was large or small the price remained the same. What was a good price in a good year might become a poor one in a bad year. The whole of the loss fell on the farmer, and it is worth noticing that the harvests of 1917 and 1919 were most disappointing in their yield, while the disastrous rain in the late summer of 1918 ruined the quality of a large part of a magnificent crop. Meanwhile the 4-lb. loaf was stabilised at 9d. at the expense of the tax-payer. Foreign wheat was brought into the country at a much higher price than that which was fixed for home-grown. Every quarter of British wheat put on the market relieved the British tax-payer, who would have had to pay something like 25s. per qr. more for the imported substitute. Consumers benefited by eating a loaf which cost them at least 3d. less than its cost to the Government and the tax-payer.

In the French war, as already stated, the poorest consumers were subsidised out of the rates; in the German war, all consumers alike were subsidised out of the taxes. Throughout, the tax-payers' burden was reduced by restricting farmers' profits. The point has been little understood. It would be, in all the circumstances, reasonable that the Wheat Commission should publish in parallel columns the prices paid for home-grown and imported wheat during the period of control. It would be an act of tardy justice to British farmers. Probably the sum which producers of home-grown wheat have, in the years 1917, 1918 and 1919, saved the tax-payer, would be in the region of £25,000,000, and possibly more.

The flat rates for beef and mutton afford another illustration of care for consumers at the expense of producers. It was essential that the scanty supply should be so distributed that those who could, or could not, afford to pay high prices should get the same quantity and the same quality. The best and the worst meat commanded the same price in the British meat-

market. Consumers were satisfied; but producers who were accustomed to supply high-class beef, mutton or lamb, suffered, and their flocks and herds were depreciated.

Other illustrations might be given of the preference given to consumers. Often, no doubt, the application of the process must have been exasperating to farmers. But there will be few who, when they look back on those times, will not recognise that it was the only principle to adopt. Its general operation certainly affords one of the most striking contrasts in the story of agriculture during the French and the German wars.

Contrasted Labour Conditions.—Another vivid contrast is offered by labour conditions at the two periods. During the French war agricultural labour seems to have been plentiful. Without an abundant supply, the work of reclamation and improvement could not have been effected. On the other hand, throughout the whole of the German war, the scarcity of agricultural labour narrowly restricted the increase of food production. So great did the strain become that by the middle of 1918 it approached to breaking point. The drain upon the manhood of the country for the naval, military and air services, and for the manufacture of munitions, exceeded anything that was experienced in the French war. As an illustration, the military forces engaged may be taken. At neither period was the nation prepared for war. In 1793, when revolutionary France put over a million of men into the field, our land forces amounted to 43,000 men in Europe, and 10,000 in India. In 1914 the total Regular Army of the United Kingdom amounted to something like 250,000 of all ranks, with which to stem the rush of the disciplined millions of Germany. At both periods we warmed to our work. In 1813, our Regulars and embodied Militia in Europe and India numbered 381,000. In the German war, if we measured our victories in trench warfare by the yard, we numbered our forces by the million. By the end of 1918, a total of 5,750,000 men of all ranks had passed into the armies of the United Kingdom. In this number and in the naval forces were included something like a third of the most able-bodied agriculturists of Great Britain, and there were many more who were drawn away from the land into other forms of civilian employment. With this reduced supply of skilled labour, the increased output of food which farmers succeeded in making was at once a notable achievement and a valuable contribution to victory.

Nor is it only in point of numbers that labour conditions have changed. During the French war agricultural wages were

substantially raised ; after the advent of peace they rapidly reverted towards their former cash level, with little or no increase in their purchasing power. It was a period when the whole rural community suffered together. But by far the worst sufferers were the labourers. During the German war, also, wages were substantially increased, and since the Armistice they have been further raised and the hours shortened. Nothing indicates more clearly the changed spirit of the times than the universal feeling that, as a result of the recent war, the position of agricultural labourers in this country must be materially improved, and not, as in 1816, materially worsened. If higher wages and shorter hours mean greater efficiency, the industry will prosper ; if they do not, the industry cannot thrive, or even exist, except under conditions which restrict employment. It rests with the men—and their leaders. Unless, as has been already said, a new earth is created, there can be no new heaven to inherit.

THE NATIONAL ASPECTS OF THE CASE FOR INCREASING THE SUPPLIES OF BASIC SLAG.*

Sir THOMAS MIDDLETON, K.B.E.,

Development Commissioner.

Food Produced by Soils of the United Kingdom.—From figures published in the annual volumes of statistics issued by the Board of Agriculture and Fisheries, and in the Report of the War (Food) Committee of the Royal Society, it may be shown that in the period before the War (1909-13) the soils of the United Kingdom were supplying products which, measured in terms of energy, would have sufficed for the support of about 17,500,000 persons. The whole population to be fed averaged about 45,250,000 persons; thus in each week the home supply would have sufficed from Friday night until Monday morning.

It is interesting to compare the position before the outbreak of war with the condition of the food supply during the last war in which the country was engaged. An examination of our imports in the early part of the nineteenth century shows that in 1801-10 the soils of the United Kingdom must have fed on an average some 16,500,000 persons. After Waterloo there was a rapid increase in our industrial population, and very great enormous pressure on the means of subsistence. In the period of reconstruction which followed the Napoleonic Wars the fare of the nation may have been meagre and was, no doubt, ill-distributed, and there was much hardship; but viewed from the standpoint of to-day, the feat performed by our farmers during that period was astonishing. By 1835 they maintained a population of 24,500,000 on the soils of the United Kingdom; in other words nearly 50 per cent. more than at the outbreak of the Great War.

Taking the soils of the United Kingdom as a whole, it may be shown that before the War farmers were providing for from 35 to 40 persons per 100 acres, and that in the period 1909-13 rather fewer than 17 persons were actually supported by the average 100 acres of our cultivated grass land. The figure for arable land, *i.e.*, under other crops than grasses and clovers, was calculated in 1916 at 84 persons per 100 acres.†

* Contribution to a General Discussion on "Basic Slags: Their Production and Utilisation in Agricultural and other Industries," held by The Faraday Society, Tuesday, 23rd March, 1920.

† The subject of the food supplies of the United Kingdom was discussed in a paper by Sir Thomas Middleton, published in this *Journal*, March, 1920, p. 1192. The figures given in that article may also be consulted.

I do not propose at present to argue out the national aspects of grass and tillage farming. Speaking from a farmer's standpoint, I am prepared to agree that in many parts of the United Kingdom the advantages of grass farming are obvious, for it must be remembered that the food problem as the farmer sees it is not the feeding of our 46,000,000 people, who have long ceased to be dependent on his efforts, but the feeding of his cattle, sheep, and other live stock. The two main human foods grown by the farmer—wheat and potatoes—occupied not more than 3,000,000 acres in the period before the War, while 36,000,000 acres were devoted to the crops required by his cattle and sheep. The value of the two tillage crops was about £27,000,000, while his live stock brought him in some £125,000,000.

Under these circumstances, the importance to the farmer of grass, the natural food of his live stock, needs no demonstration. Since grass is so important its present quality and the scope for improvement are points to which I wish to direct your attention.

The Scope for Improvement in our Pastures.—So far as I am aware, there are no trustworthy records from which the average production of meat by our finest permanent pastures can be estimated.

The best fattening pastures that I personally have met with are in the Market Harboro' district of Leicestershire, and I estimate that the richest field in the district, which I examined, would on an average of years produce from 180 to 200 lb. of meat without the assistance of oilcakes. The field in question fattened a bullock per acre in the early part of the grazing season, made a "forward store" without oilcake, or a fat beast with oilcake in the autumn, and, in addition, would provide some keep for store cattle or sheep in the winter months.

How many of our 33,500,000 acres of grass land come up to the level of the pasture described above? If one were to form an estimate from the newspaper controversies that centred round the ploughing up of grass land during the course of the War, one would probably be prepared to believe that about one-third, or possibly even one-half, of the grass land of England was of fine quality. In spite of the careful way in which the Agricultural Executive Committees in most cases selected land for ploughing, one heard constantly of their errors in destroying fine grazings to provide land for corn. Their task was to select no more than one-eighth of the grass land of England and Wales for ploughing, and although, notwithstanding their

efforts, less than 2,000,000 extra acres were in fact ploughed up, it was freely alleged that the live stock interests of the country were being jeopardised to provide wheat and oats. Clearly, if one believed all this war-time evidence, the pastures of England were a national heritage of great value. But let us test the position in another way. Is it possible that anything like one-third of our pastures can be up to the level of the "one-fat-bullock-per-acre" standard? What are the results of the grazing industry? The total number of grass-fattened cattle marketed in the United Kingdom does not exceed 1,000,000 per annum, and it is common knowledge that a large percentage of this number is fattened with the help of oilcakes. Personally, therefore, I should be surprised to find that there are, in fact, 500,000 acres of grass land in this country which, without the help of concentrated feeding stuffs, fatten one bullock per acre on the average of a series of years.

Now what about the other end of the scale? What yield may be expected from our poorest cultivated pastures—I do not refer to our 15,000,000 acres of hill grazings, which probably produce less than 5 lb. lean meat per acre per annum, but to our so-called cultivated land. My own estimate is that land of this type—poor clay soil pasturage very common in the North of England—yields from 15 to 20 lb. of lean meat per acre in the course of a year. Other experimental pastures in Northamptonshire and Cambridgeshire which I have had an opportunity of studying produced from 20 to 25 lb. of lean meat in an average season, and from the opportunities I have had of inspecting poor pastures in many parts of the country, I have come to the conclusion that there are very many thousands of acres of grass land in the United Kingdom from which the nation obtains no more than 25 lb. of lean meat in the course of a season.

With the information at present available, it is not possible to make any close estimate of the average production of meat on the pastures of the United Kingdom. In the first place, we do not know the total production. In the 5 years before the War it was estimated at 1,150,000 tons of beef and mutton, but with the more accurate information at the disposal of the Ministry of Food, it was found that in 1919 we produced some 875,000 tons only. There has been a considerable reduction in the number of sheep, especially of the larger sheep fed in the South of England, but the number of cattle is practically the same as in 1914. Feeding stuffs were scarce, and cattle were smaller than before the War. But when full allowance

has been made for these circumstances, it is not possible to resist the conclusion that we over-estimated out meat production in the period before the War.

Even if we knew the total output of meat, it would be necessary before estimating the production of our grass land to ascertain (1) the production from hill grazings, (2) the yield from the products of arable land, and (3) the amount due to imported feeding stuffs. Though it is possible to make more or less satisfactory guesses at the yield from each of these sources, it will be evident that no great accuracy can be claimed for the final result of an estimate that has in view so many uncertain factors. On the basis of the estimated pre-war production of meat, my former view was that the pastures of the United Kingdom produce on the average 100 to 110 lb. of lean meat per acre per annum, but at present I am disposed to think that go to 100 lb. would be nearer the mark.

Moreover, the meat of the "average" pasture is very different in quality from that produced on the finest pasture. The nutritive value of the lean meat of our "average" grazings is probably less than two-thirds of that of the fat meat produced on feeding pastures. Taking both the quantity and quality of the meat produced into account, it follows that our best pastures have about three times the value of our "average" pastures as sources of human food, while they may be 10 or 12 times more productive than the poor pastures that replace the former corn lands of many parts of the country. Anyone who has investigated the subject must agree that our pastures offer great scope for improvement. Let me illustrate the extent to which improvement may occur. In 1902 I laid out four 10-acre fields on the unimproved pastures at Cockle Park, Northumberland; basic slag and other manures were applied. This land in its unimproved state produces about 20 lb. of lean meat per acre per annum. Records have been kept ever since, and it is shown that on the average of two of the fields, and during the 11 years, 1904-14, the live increase made by cattle and sheep on these 20 acres was equal to about 105 lb. of meat per acre, or more than five times the yield of the untreated land. The special interest of this experiment is that the improvement was due to basic slag. The results of many other experiments might be cited to prove that on thousands of acres of this country the yield might be equally increased by the proper use of basic slag.

The effect of the application of basic slag to some types of pastures is so striking that the results have been described as

magical ; but there is no " magic " in the action of the manure. This depends on the habit and manner of growth of white clover on land that has been depleted of phosphates by corn growing, and has then been left to " tumble down " to grass.

Most agriculturists will agree that, in conjunction with white clover, basic slag is the most potent agent known for restoring fertility to worn-out corn land. If the old corn-growing lands of England are again to take their place in producing wheat, it seems probable that one feature in the scheme of management to be adopted will be the alternation of corn-growing with a period during which clay soils will rest and regain fertility by growing clover manured with basic slag.

Effect of Pasture Improvement on Tillage Farming.—Apart from the uncertainty as to the future cost of labour, the chief obstacle to the expansion of tillage in this country is the difficulty that farmers would experience in devising means for supplying their live stock, were they to be deprived of any considerable proportion of the grass now grown by them. It is well known that, given the necessary skill and the command of capital and labour, food for live stock may be raised in greater quantity from land under the plough than from grass ; but it is certain that in many instances stock could not be kept so cheaply as they now are, were grass land to be broken up ; and it is further certain that the stock farmer would be less free from anxiety if tillage crops replaced his pastures. Any policy which aims at extending the corn fields of England must, therefore, reckon with strong opposition, if the increase of corn means the decrease of grass and hay. But it seems to me that the area under corn could be largely extended without reducing the natural foods of our live stock ; for, given enough basic slag, it would be an easy matter, in my opinion, to restore all the land well adapted for corn growing to tillage, and to grow as much grass and hay as we do at the present time.

In the early seventies of last century England and Wales had about 15,000,000 acres under the plough. Before the War the area had fallen to 11,250,000 acres. In 1918 it had increased to 12,500,000. Although labour is less plentiful and much more expensive than in the seventies, there should be no difficulty, given remunerative prices, in again reaching the 15,000,000 level, for in the interval the farmer's command of machinery and of manures have both greatly increased. In the immediate future the lack of buildings must prevent any considerable extension of tillage, but a time will come

again, it may be anticipated, when builders will be glad to secure work, and when materials will be forthcoming. It is, I think, beyond dispute that 15,000,000 acres of land suited for tillage could be found; what the farmer argues is that in view of the increase in his herds he could not carry on his business with 12,000,000 acres of grass only in England and Wales; he wants to have the 16,000,000 he had available in 1914. As I have already indicated, I admit the difficulty. I do not say to him: "The extra 4,000,000 acres under tillage would feed as many animals as the 4,000,000 acres grass ploughed up." In theory they could do so; in practice the farmer might not succeed in the attempt. What I should prefer to say is: "Given manure and reasonable management, there will be no difficulty in growing as much grass and hay on 12,000,000 acres in future as you produced on 16,000,000 before the War."

Let us further examine this statement.

Of the 16,000,000 acres under grass at the outbreak of war there may have been 1,000,000 so good that no marked response to manuring could be expected, and 3,000,000 on soils so dry and arid that no scheme of manuring would prove profitable. This would leave a balance of 12,000,000 acres susceptible of profitable improvement. In view of the wide extent of our clay soil and chalk pastures, and the extraordinary response which most pastures and meadows on such soils make to the application of basic slag, it seems to me to be reasonable to assume that if 4,000,000 acres of these permanent pastures were ploughed, the remaining 8,000,000 acres could produce as much grass as is now being grown on the whole 12,000,000 acres.

Value of Extra Tillage Land to the Nation.—The value to the community of these 4,000,000 extra acres under the plough would be much greater than at first might be supposed. The full effect is not apparent from the simple proportion, 11:15.

Opponents of a plough policy usually start off with the assumption that the corn-growing capacity of Britain in proportion to her needs is so small, that any effort which might be made to increase home supplies would have negligible results. This assumption is far from being correct.

I estimate that if the necessity arose, and all the products of the soil were carefully rationed and efficiently distributed, the present population of the United Kingdom could be supplied with breadstuffs from the produce of about 14,000,000 acres of corn. Towards this total England and Wales would be required to contribute 10,000,000 acres. Now, with 11,000,000 acres under

the plough, as in the pre-war period, and with the system of farming then current, we would normally grow 5,750,000 acres of grain. Should high prices continue to rule, it is probable that 6,250,000 acres would be forthcoming. With 15,000,000 acres under the plough, we would grow from 7,500,000 acres when corn prices were low to 8,500,000, or even 9,000,000, when prices ruled high (the average for the period 1871-75 was 8,100,000 acres). Should danger arise, it would be impossible to secure 10,000,000 acres of corn in England and Wales, if we started, as in 1914, with no more than 11,000,000 acres of tillage land. In spite of the great effort made, we got only 7,500,000 acres in 1918. But if we began with 15,000,000 acres of tillage in hand, our task, though formidable, would be by no means impossible. An extensive grass-ploughing campaign would, no doubt, be called for, but we should start on the effort to secure 2,000,000 or 3,000,000 extra acres of corn, with the buildings, the men, the horses, and the machinery which 15,000,000 acres of tillage would support in time of peace, instead of with the men and equipment of 11,000,000 acres.

In a war crisis, therefore, these extra 4,000,000 acres of tillage land would mean the difference between the provision of a sufficient, if meagre, supply of breadstuffs for the whole population, and a curtailment of the supplies that would lead, in the first place, to a breakdown of the machinery for rationing and later to famine and to the popular ferment that would inevitably seize a people deprived of a sufficiency of bread. It would mean the difference that there was between our own comfortable, if somewhat unattractive, diet in the last two years of the War, and the makeshifts on which our enemies attempted to fill, but failed to feed, themselves.

But, it will be argued, "why prepare for another great war when we have made an end of great wars, and why suppose that if there is a war, imports will not reach us with as great certainty as they did between 1914 and 1918? We have shown how to defeat the submarine, and we can safely rely on our Navy and merchant vessels in any circumstances that may arise." Let us admit this contention, even if we feel the argument to be unconvincing, and examine the case for the extra 4,000,000 acres as a peace proposition.

On the lavish scale on which this rich nation fed itself and its live stock in the period 1909-13, I estimate that some 21,000,000 acres growing "average" (*i.e.*, average British) crops would be wanted to supply the cereals consumed in the United Kingdom. The area under these crops in the United

Kingdom in 1909-13 was between 7,500,000 and 8,000,000 acres. About 2,000,000 acres were contributed by Scotland and Ireland. As I am discussing the subject from the standpoint of England and Wales only, we may assume that their share in the 21,000,000 acres that would be called for if all our cereals were home grown, would be between 17,000,000 and 18,000,000 acres. The actual contribution made by England and Wales in the period 1909-13 was 5,800,000 acres. Under the influence of high prices this area might be increased to 6,250,000 acres, *i.e.*, to 36 per cent. of the area required for a full supply.

Having regard to the large proportion of our area under permanent grass, and the demands which live stock fed on poor grass land necessarily make on the products of arable land, it is unlikely that even if corn prices remained at the present high level and the shilling loaf were permanent, we would have more than 6,500,000 acres under grain.

Under the conditions which I have postulated for an arable area of 15,000,000 acres, the limits of corn growing would be wider. I have assumed the improvement of some 8,000,000 acres of pasture by 50 per cent. . What I meant to convey was that 8,000,000 acres of grass could be made capable of carrying 50 per cent. more stock during the summer season, and of producing 50 per cent. more hay. But there would be a second important result of such a change. An improved pasture has a much longer grazing season than an unimproved; the grass comes earlier and lasts later; thus, assuming the same numbers of cattle and sheep to be kept through the summer on similar areas of improved pasture that had previously been kept on 12,000,000 acres of unimproved land, there would be a smaller demand for winter keep in the one case than in the other.

A second circumstance favouring wider variations in the area reserved for corn growing with a total of 15,000,000 acres arable land than with 11,000,000 should be pointed out. The additional 4,000,000 acres would, for the most part, consist of the heavier soils; these are more expensive to till, and when supplies of grain were abundant and prices low, a long rotation would, and should, be adopted. I say "should," because it is just these soils that, with the assistance of basic slag and white clover, might very profitably be laid down to temporary leys. When supplies were scarce and prices rose, this same land would stand a good deal of intensive corn growing. Thus I estimate that while with 15,000,000 acres of arable land the probable area under grain would vary from 7,500,000 to 8,500,000 acres, the upper limit,

if favoured by a wise national policy, might well reach 9,000,000 acres. If, however, we adopt the more conservative figure of 8,500,000 acres under grain, we should even then increase our home supplies by 12 to 14 per cent. An increase of this amount would not only substantially diminish our foreign purchases, but would tend to reduce fluctuations in price; for, in spite of the abuse which we bestow on our British climate, it seems to me that our own harvests may well fluctuate less in amount than the average of the exportable surplus of the harvests from which we must draw our future supplies. This is not the time to discuss the prospects of our future wheat supply, and I cannot pretend to have an expert knowledge of the wheat trade; but when I look to the sources from which our supplies were drawn in the past, to the effect which war has had upon the soils and the labour that produced our wheat, and to the great fluctuations in yield due to climate, it does not seem to me that a nation which depends so largely as we have done in the past on "exportable surpluses," can escape great fluctuations in the price of bread.

Occasional high prices, even frequent high prices, will not in themselves secure a permanent addition to the area under tillage. Other measures are called for, and among the most important is an effort to increase the output of basic slag, so that the quality of our grass land may be improved.

To the steel maker the slag which he produces is no doubt a secondary consideration, but I hope that his concentration on improvements in the manufacture of steel will leave him with time and inclination to bestow attention on processes by which the quality and output of basic slag may be increased. I have endeavoured to direct attention to the national importance of basic slag, and I hope I have succeeded in indicating that its manufacture is not merely of interest to the farmer as a means of providing a profitable manure for his pastures, but that it has a direct bearing on the future of the bread supply of those engaged in the steel industry and of their fellows in our other industries. The conditions affecting the food supply of the industrial classes are very different from what they were in 1820, but let us not forget that they are also very different from what they were in 1914. The extent to which our urban population may be driven to rely for their supplies of food on the soils of this country cannot be foreseen. We must not too confidently assume that all that we ask for will be supplied by other countries. There may still be "hungry forties" ahead of us.

THE "ROYAL'S" WAR RECORD.

J. P. GOODWIN.

THE Royal Agricultural Society of England can fairly claim to have carried out no less satisfactorily during the years of war than in those of peace the task allotted to it 82 years ago—the general advancement of English agriculture. It will not be denied that the farming industry has made great progress under the stimulus of the "Royal," and more especially in the improvement in live stock and in agricultural machinery, due to the competitions and demonstrations at the Society's annual shows. With the exception of 1866, the "Royal" show has been held annually down to 1917, in which year, and the one following, the critical state of the War led to its abandonment.

Thus compelled to rest from one of its chief labours, the Society endeavoured to assist in the solution of the problems born of the exceptional times. The Council therefore appointed a War Emergency Committee for the following purposes:—To advise the Government Departments, if they so desired, by focussing the opinion of agriculturists all over the country; to give confidence to agriculturists by providing a body which could help to solve many of their present difficulties and take up their just grievances; to reassure the public by devoting its attention to the maintenance of the food production of the country; to sift the proposals being put before the country as to what should be done with the land, and to consider the effect of Government orders and regulations on production.

The Society consistently sought to assist the Government, and more especially those departments concerned with the fixing of prices, which were particularly in need of expert and unofficial guidance. One effect of the Society's work in this direction was to reassure the public, for it was recognised that a practical body of men was devoting its attention to the maintenance of food production. Another result was to show that the patriotism of the farmer was as genuine and deep as that of any other class. Prompt and emphatic protest on the part of the Society against the charges of apathy and profiteering which were sometimes laid at the door of the farmer had the effect of securing a fairer field for harassed agriculturists, and strengthening confidence. At the same time the Council urged the farmer to make the utmost use of such facilities

as were available, and to exercise economy in the use of feeding stuffs, while it gave the weight of its influence in support of the official campaign for food production and food saving.

One of the earliest resolutions of the War Emergency Committee uttered a caution against the excessive ploughing up of grass land, and the Society had the satisfaction of securing a declaration by the authorities that grass land which was fully productive for milk or fattening cattle should be left down, although it was not always possible to adhere rigidly to this principle. It was also urged, with ultimate success, that the ploughing up of grass land should be accompanied by the establishment of guaranteed prices for cereals for a period of years. From the very beginning the "Royal" insisted that the prices fixed for the farmer's produce should be based upon the cost of production plus a fair margin of profit, and that the cost of such essentials as feeding stuffs and fertilisers should also be fixed. In the same way the Society, by the recommendations which it made to the Government, was successful in securing concessions which were not only of direct benefit to the farmer but ultimately in the interests of the country as a whole.

In a still more direct way the Society took part in assisting the Government by nominating members to act on several of the official Committees set up to advise as to the probable operation of contemplated measures of control. In particular the Society's representatives on the Central Advisory Council did most valuable work in reconciling, as far as possible, the demands of the consumer with the requirements of the producer.

Agricultural Relief of Allies.—Another important feature of the Society's war work was the inauguration of the Agricultural Relief of Allies Committee. From the outset English farmers felt the deepest sympathy with the agriculturists in Belgium, France and Serbia in the ruin and suffering imposed upon them by a merciless invader. It was therefore fitting that the "Royal" should come forward and give cohesion to the help offered throughout the country to enable the Allied farmers to resume cultivation of their holdings when the opportunity should arrive. The lead given by the Society was in keeping with its action in 1870-1, when it established a fund for supplying seed corn to the peasants in the northern and eastern regions of France, whose crops had been destroyed in the Franco-Prussian War. With His Majesty the King as Patron, the Agricultural Relief of Allies Committee came into existence

in 1915. The Breed Societies, the Central Chamber of Agriculture, the National Farmers' Union, and practically all the county agricultural associations joined heartily in the movement, and the Committee became representative not only of every phase of agricultural activity in this country but of Dominion agriculturists as well. A start was made with relief work in the Marne and Meuse in 1915 in those districts liberated by the first victory of the Marne. A large number of Southdown rams, including five given by the King, many ploughs, harrows, cultivators, drills, and binders, as well as considerable quantities of seed corn and seed potatoes, were sent and distributed.

The Committee's opportunities for relief, however, diminished when the War became an affair of trenches and long-range artillery, and although small shipments of seeds, live poultry, and fruit trees, were sent to France while fighting was still in progress, it was not possible to embark upon the main programme of relief until after the Armistice in November, 1918. By that time the Fund had been raised to over £200,000, this sum being obtained very largely by means of gift sales organised in the principal agricultural centres by the county committees.

In France and Belgium it was decided to restrict operations to districts where the agricultural industry had most seriously suffered, and in each case these happened also to be districts which British soldiers had defended—the Department of the Somme in France, and the Valley of the Yser in Belgium. The great need in both regions was for a supply of milk, the Belgian district in particular having previously been renowned for its dairy produce. In the Somme, however, there was an absence of buildings for the accommodation of cattle, and the Committee therefore sent consignments of pigs and poultry at first, and did not distribute any cattle until June, 1919, when the situation had sufficiently improved to justify sending such stock. In Belgium, on the other hand, there was, behind the actual battle-front, accommodation for dairy stock from the first, and within four months after the Armistice the Committee had placed over 300 head of British dairy cattle on the pastures of devastated Belgium. Other cattle, together with sheep and pigs, followed in both countries, and the Committee has received abundant evidence of the important part played by its gifts in the work of reconstruction. A matter for satisfaction is the care which has been bestowed upon the animals by their new owners, and with very few exceptions

the British stock has done extremely well. About 600 dairy cattle and 2,000 head of poultry were sent by the Committee to Serbia for distribution in the neighbourhood of Shabatz, and a number of poultry were given to Polish peasants.

The Scottish Committee for Belgian relief, formed by the Highland and Agricultural Society, co-operated with the Relief of Allies Committee and sent a splendid lot of Ayrshires to the Pervyse district of Belgium, while a Canadian sub-committee has given large quantities of small tools to Allied peasants who have returned to their battered holdings. The amount given by the Committee is indeed small in comparison with the vast extent of the damage, but the policy of concentration has ensured that the relief shall constitute a lasting memorial of the practical help of all British agriculturists whose generosity the Society had the privilege of co-ordinating and making effective.

The following shows at a glance the relief given by the Committee since the commencement of the Fund:—

	<i>France. Belgium. Serbia. Poland. Total.</i>				
Bulls	55	50	30	—	135
Heifers	782	790	550	—	2,122
Rams	231	65	—	—	296
Ewes	1,795	1,475	—	—	3,270
Boars	45	63	—	—	108
Gilts	471	593	—	—	1,064
Goats	2	413	—	—	415
Poultry and Eggs for hatching	7,042	7,664	2,000	362	17,068

In addition, 151 agricultural implements, such as binders, ploughs, etc., together with 3,700 sacks of seed corn and potatoes, and 8,850 fruit trees, were sent to France.

PROFIT AND LOSS SHARING IN AGRICULTURE.

JAMES WYLLIE, B.Sc., N.D.A. (Hons.).

THE publication of the writer's Scheme of Profit and Loss Sharing in Agriculture in this *Journal** and elsewhere has created considerable discussion, not only as to whether the Scheme proposed is sound in principle but also as to its practicability. The question of principle will always be a matter of opinion, but it is likely that as many employers, and especially farmers, will cavil at the practicability of profit and loss sharing as at the principle involved. Indeed, a common objection amongst farmers is that profit and loss sharing implies not only that accurate accounts must be kept but also that they must be regularly audited by a qualified person. In these circumstances a useful purpose may be served by showing how the Scheme would and does work out in practice.

1. The Balance Sheet.—The foundation of any profit and loss sharing scheme is a properly constructed balance sheet showing *inter alia*, the actual amount of capital invested in the farm. Since capital is one of the factors to be remunerated, the amount must be accurately determined. In particular, the valuation of stocks in hand must be neither too high nor too low, while the amount included for cash at the bank should not be more than is necessary to carry on the farm as a business proposition. Except in special circumstances (which, it may be said, will quite frequently arise), the valuation should be made either according to standard or fixed values, as in the case of sheep stocks, dairy herds and working horses, *or* on the basis of estimated cost of production or market value, whichever is the lower. It is highly desirable, and will make for confidence amongst the employees, that the valuation be made by a disinterested party, and that the balance sheet be properly certified.

2. Rate of Interest on Capital.—At the outset an agreement should be arrived at between the employer and the employees as to the rate of interest which is to be allowed on the invested capital. Under present conditions it is suggested that the

* See Vol. XXVI. No. 9. December, 1919, pp. 910-913, which should be read with this article.

rate should not be less than 5 nor more than 7 per cent. per annum. These limits are put forward for the principal reason that employees are not likely to agree to more than 7 per cent., while the employer is not likely to accept less than 5 per cent. per annum, and it is more important to have agreement than to attempt to justify a certain rate by reference to the riskiness of farming as a business, or by pointing to prospectuses offering 8, 9 and 10 per cent. per annum on what are called Preference Shares.

3. **Accounts.**—For the purposes of profit and loss sharing, nothing but a simple system of accounting is required, but a complete record should always be kept of the wages paid to each hired worker. Particulars should also be kept of all ordinary manual work done by the farmer or by members of his household, and it is desirable that a weekly or monthly record should be kept of farm produce consumed in the farm house.

4. **Employees' Wages.**—The main object in this connection is to ascertain the total *earnings* of all the hired workers, including cash wages, payments in cash for overtime, harvest, lambing, etc., and perquisites or allowances of all kinds—cottage and garden, board and lodging, potatoes, milk, oatmeal, etc. Perquisites should generally be valued on the basis laid down by the Central Wages Board, but there is, of course, no reason why the employer and employees should not agree upon another scale. The scale adopted here should also be used in valuing farm produce consumed in the farm house. Profit and loss sharing would be simplified if all wages were paid in cash. It will be clear that the inclusion of perquisites or allowances at this point is necessary, not to enable the profit to be accurately determined (for this is not affected), but to enable the profit to be equitably distributed.

5. **Employer's Wages.**—This term is used to cover the value of ordinary manual work done by the farmer or by members of his household, as well as for his services as manager of the business. Manual work should be charged at current rates for hired labour of the same class, while the charge for management should be based upon salaries actually paid to farm managers in the district. The main desideratum here, again, is that there should be agreement as to the rates and total amount to be charged for employer's wages, and, in any case, employer's and employees' wages should rise or fall together.

6. Farm Credits.—The farm must be credited with the estimated annual value of the farm dwelling-house as well as with all farm produce used in it.

7. Profit or Loss.—The profit to be distributed (or the loss shown) will appear after making the adjustments above indicated, that is, after charging the farm with (a) Interest on Capital, (b) Employees' Wages, and (c) Employer's Wages—the rest of the accounting being on the usual lines.

8. Example.—The following example may now be given to show how the Scheme would work in practice. On a certain farm accurate accounts have been kept since 1905, and the summarised results for the last two years were as follows:—*

Year ending Michaelmas.	1918.	1919.
	£	£
Receipts during year	4,064	3,752
Capital at end of year	4,765	4,775
	<u>£8,829</u>	<u>£8,527</u>
Capital at beginning of year	3,947	4,765
Payments during year	3,992	3,342
Balance	890	420
	<u>£8,829</u>	<u>£8,527</u>
Cash wages paid	<u>£619</u>	<u>£874</u>

For profit and loss sharing purposes the following adjustments would be necessary:—

	1917-18.	1918-19.
	£	£
(1) Cash wages paid	619	874
Add Rent of two cottages (only perquisites)	10	10
<i>Total Employees' wages</i> ..	<u>£629</u>	<u>£884</u>
To be divided into—		
Wages paid to "ineligible" workers	40	64
Wages paid to "eligible" workers	589	820
	<u>£629</u>	<u>£884</u>

- (2) It was agreed to allow the farmer £300 per annum for management, while the work of two sons was valued at £125 in 1917-18 and £160 in 1918-19, hence total *employer's wages* was £425 and £460 in 1917-18 and 1918-19, respectively.

* All figures given to the nearest £1.

	1917-18.	1918-19.
	£	£
(3) Balance as shown above ..	890	420
Deduct : Interest on Capital at 5 per cent. 197	197	238
Employer's wages .. 425	425	460
	<u>622</u>	<u>698</u>
	268	.. (-) 278
Add : Rent of farm house .. 20	20	20
Farm produce used in house 80	80	110
	<u>100</u>	<u>130</u>
	368	.. (-) 148
Deduct : 10 per cent. to Reserve Fund 37	37	—
	<u>—</u>	<u>—</u>
Actual Amount for Distribution £331	£331	—
(4) Proportion allocated to Employer, viz. :—	£	
425 of 331 = 133		
629 + 425		
Proportion allocated to ineligible Employees (to be added to Reserve Fund), viz. :—		
40 of 331 = 13		
629 + 425		
Proportion allocated to eligible Employees, viz. :—		
589 of 331 = 185		
629 + 425		
	<u>£331</u>	

The net result, therefore, in 1917-18 is that £50 (£37 + £13) is placed to reserve, while the employer gets £133 and the employees £185, both sums being paid in cash.

This latter sum has now to be distributed over the eligible workers according to the total earnings of each as shown by the wages record. In this case there were 11 workers regularly employed, so that the average share per worker is about £17, or 6s. 6d. per week.

So far as the year 1917-18 is concerned there has been no difficulty, for the principal reason that there has been a surplus profit to be shared. What about 1918-19, however? Here there is a deficit, for profit sharing purposes, of £148.

As a pure matter of logic, it might be urged that this loss should be shared on essentially the same lines as the profit, *i.e.*,

between the employer and employees. On the other hand, any such proposal would effectively ruin the scheme in the eyes of the workers, and in any case it must be recognised that wages cannot be expected to *fluctuate* in the same way as profits.

In such circumstances as the above the writer has proposed to carry forward the deficit to the year 1919-20 and make it a first charge on the surplus shown for that year, or, the reserve fund may be drawn upon to cancel whole or part of the deficit.

9. The Reserve Fund.—It is clear that the most critical time in the life of a profit and loss sharing scheme is the period which elapses before the reserve fund has reached an amount large enough to meet the contingency which has here arisen. Various methods of meeting this difficulty have been suggested, such as the creation of a reserve fund by the employer at the commencement of the scheme. On a broad view of the case, however, it is obvious that unless such a scheme can be completely self-supporting *over a period of years* it cannot possibly survive for very long. In other words, the scheme ought to resolve itself into a *profit-sharing* scheme. Losses there may be in occasional years or even in successive years, but unless the profits exceed the losses by an appreciable amount over a period of years nothing can save the scheme from speedy extinction.

It may be useful, therefore, to take the results from the farm in question and show how a profit-sharing scheme would have worked out had it been in operation since 1905. These results are summarised in Table I. (p. 260.)

10. The Scheme for 14 years.—It is evident that had the scheme started in 1914 the reserve fund in 1918 would have been large enough to tide over the year 1918-19. In the table, the deficit of £148, together with sufficient to pay a 5 per cent. "dividend" on wages, viz., £64, has been drawn from the reserve fund, which at Michaelmas, 1919, stands at £334. Had the reserve fund been larger it would have been possible to pay up to 10 per cent. on wages, but in view of the previous experience it would appear to be unwise to make too severe a call upon the reserve fund.

In considering this table attention may be directed to the following points:—

- (a) A profit and loss sharing scheme was not actually in operation on this farm,
- (b) The *Balances* shown and the cash wages paid are as given in the accounts, but the adjustments which have been made are not necessarily those which

would have been agreed upon between employer and employees. This latter fact, however, does not detract from the value of the table as an illustration of the principle of profit and loss sharing.

- (c) It is clear that had the scheme started in 1909-10, it would almost certainly have failed, simply because there were no profits to share for a period of 4 years in succession. On the other hand, a start in 1905-06 might have enabled the scheme just to survive the lean years of 1909-10 to 1912-13, for by this time the employees would have felt the benefits during 1905-06 to 1908-09.
- (d) In any case, it must be emphasised that if the objects of profit and loss sharing had been realised, not only would the profits have been greater in the good years but also the losses would have been less in the poor years. The table shows that during the 14 years 1905-06 to 1918-19 the sum of £2,635 was distributed amongst the employees, while £1,390 was allocated to the employer. This is equal to about £188 per annum to employees and about £100 per annum to the employer. Assuming an average of 10 regular employees, the net result is that each employee would receive over £18 per annum, or about 7s. per week on the average.

Now, the result of the operation of a profit and loss sharing scheme should be to increase the total profits over a period of years—such increase being due not only to increased effort on the part of the employees but also to better organisation on the part of the employer and to the much greater confidence which it gives him in the direction of more intensive production in every way. Unfortunately, it is impossible to make any useful estimate of what this increase in profit might amount to, but it is clear that unless the employer is satisfied that there is an increase he will, rightly or wrongly, be inclined to think he is giving "something for nothing."

- (e) The question is commonly raised: In what way do the employees share in the *losses*? The table given should make it quite clear that they do share. Assuming that during the years 1909-10 to 1912-13 the employees had done their utmost, but that for reasons beyond the control of either employer or

TABLE I.—*Profit and Loss Sharing Statement for the 14 Years 1905-6 to 1918-19.*

Year ending Michilmas ..	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
I. Receipts during year ..	£ 1,886	£ 1,910	£ 2,020	£ 1,685	£ 1,759	£ 2,033	£ 1,575	£ 1,692	£ 1,773	£ 2,430	£ 2,673	£ 3,047	£ 4,064	£ 3,753
Capital—end of year ..	2,401	2,449	2,265	2,564	2,394	2,038	1,933	1,968	1,774	2,431	3,033	3,047	4,755	4,775
Totals ..	4,287	4,359	4,285	4,249	4,133	4,071	3,508	3,666	3,497	5,091	5,916	6,094	8,809	8,527
Capital—beginning of year ..	2,423	2,402	2,449	2,265	2,364	2,334	2,038	1,968	1,698	1,724	2,431	3,047	3,047	4,765
Payments during year ..	1,433	1,359	1,434	1,484	1,460	1,738	1,469	1,555	1,493	2,512	2,731	3,066	3,992	3,342
Balance ..	301	379	377	653	160	64	27	325	356	3,155	1,348	1,533	890	420
Totals ..	4,287	4,359	4,280	4,249	4,133	4,241	3,425	3,560	3,497	5,391	5,910	6,416	8,829	8,537
II. Cash Wages Paid ..	485	416	434	420	370	361	387	393	388	433	473	536	619	874
Add rent of Cottages (2) ..	30	10	10	10	10	10	10	10	10	30	10	10	10	10
Totals ..	496	426	444	430	380	371	397	403	398	443	483	546	629	884
Total Employees' Wages ..	30	35	30	28	33	24	18	34	36	33	48	36	40	64
Proportion to Ineligible Workers ..	466	421	414	402	347	347	379	369	362	410	435	510	589	820
III. Management Charge ..	160	160	160	160	160	160	160	160	160	180	200	250	300	300
Work done by two Sons ..	—	—	—	—	—	—	—	—	—	39	41	60	125	160
Totals ..	160	160	160	160	160	160	160	160	166	219	241	310	425	460
IV. Balance, as above ..	301	379	377	653	160	64	27	325	356	1,155	1,348	1,533	890	420
Dividend Interest plus Employer's Wages ..	245	246	246	238	230	244	241	234	234	305	362	507	622	698
Add Farm House Rent (£20) plus Farm Produce used in House ..	56	335	331	414	—	180	—	—	104	830	986	1,026	268	—
Carry to per cent. to Reserve Fund ..	116	395	191	474	—	—	—	—	—	70	80	80	100	130
Amount available for Distribution ..	12	39	19	47	—	—	—	—	—	70	80	80	100	130
Allocated to Employees ..	204	356	172	427	—	—	—	—	—	88	960	996	331	64
Allocated to Employer ..	25	93	46	116	—	—	—	—	—	274	319	361	383	41
" to Reserve ..	74	243	178	291	—	—	—	—	—	513	564	542	123	41
Total Reserve Fund ..	5	20	8	20	—	—	—	—	—	41	344	496	546	331
Totals ..	17	76	103	170	140	80	8	0	41	174	344	496	546	331

Notes:—(1) Interest charged at 3 per cent. per annum for 1907-6 to 1918-19. (2) Interest charged at 3 per cent. per annum for 1905-6 to 1906-7. (3) Interest charged at 3 per cent. per annum for 1906-7 to 1907-6. (4) Interest charged at 3 per cent. per annum for 1907-6 to 1908-7. (5) Interest charged at 3 per cent. per annum for 1908-7 to 1909-8. (6) Interest charged at 3 per cent. per annum for 1909-8 to 1910-9. (7) Interest charged at 3 per cent. per annum for 1910-9 to 1911-10. (8) Interest charged at 3 per cent. per annum for 1911-10 to 1912-11. (9) Interest charged at 3 per cent. per annum for 1912-11 to 1913-14. (10) Interest charged at 3 per cent. per annum for 1913-14 to 1914-15. (11) Interest charged at 3 per cent. per annum for 1914-15 to 1915-16. (12) Interest charged at 3 per cent. per annum for 1915-16 to 1916-17. (13) Interest charged at 3 per cent. per annum for 1916-17 to 1917-18. (14) Interest charged at 3 per cent. per annum for 1917-18 to 1918-19.

employees the farm still showed losses, is it not true to say that the employees had given "something for nothing," *i.e.*, that they had shared in the losses? They had worked harder than they had any need to, and for this extra effort they had received nothing.

- (7) Lastly, it must be pointed out that the relatively high profits shown during the war years were partly due to the realisation of the capital in the soil by cross-cropping and so on. Hence, had a scheme of profit and loss sharing been in operation, the farmer would have been justified in placing a certain amount to a Special Reserve Account towards the time when this capital had to be put back into the soil.

11. Conclusion.—It is not possible nor desirable in an article such as this to go into details of the actual book-keeping entries which would be necessary to give effect to the above proposals and results. Suffice it to say that this is a comparatively simple matter, and, as already indicated, would be subject to the scrutiny of a qualified auditor. It only remains to mention that suitable steps should be taken to ascertain the views of the employees before any decisions are arrived at, either by meeting the employees as a body or, preferably, by meeting a small committee appointed by themselves. Given confidence between "master and man," there is every reason why a scheme of profit and loss sharing should succeed; without this confidence it is almost certain to fail.

THE ALLOTMENT MOVEMENT IN ENGLAND AND WALES.

SIR DANIEL HALL, K.C.B., F.R.S., has recently delivered a series of three Chadwick Lectures at the Royal Sanitary Institute on the Nation's Food Supply, with special reference to the allotment movement. An abstract of the first lecture, entitled "Our National Food Supply: the Limits of Self Support," was published in the issue of this *Journal* for last month, p.133. The two subsequent lectures dealt with the possibilities of allotments in this country, both from the economic and the social point of view. The following is the substance of Sir Daniel Hall's remarks in his second and third lectures:—

In the second lecture Sir Daniel Hall discussed the practical working of allotments. He opened with a brief history of this branch of land cultivation, which goes back to a very early date. Statutes of the time of Henry III. seem to indicate that wherever changes in land occupation tended to make labourers landless, measures were afterwards taken to assist them to obtain control over a small portion of cultivated ground. The gross effect, however, was never great, and it is estimated that in the early years of last century less than 1,000 rural allotments existed in the county of Oxford. During the last century the movement spread steadily, stimulated for a time by the wages agitation of the 'seventies, but beneath the advancing wave of agricultural depression the effort died away. Two classes of allotments were discussed; the comparatively small allotment, really a detached garden, worked by the wage-earner in towns and villages, and the larger parcel of land by which the rural labourer has attempted to eke out his indifferent earnings. As a rule the occupier of the first class of allotment consumes all the produce, whereas the occupier of the second class aims at having some surplus to sell.

In the last return of land occupied as allotments under the Small Holdings and Allotments Act, the average size of the holdings was one-sixth of an acre, which shows that many of the allotments are on the large side. During the War, on the other hand, the 273,000 allotments created by local Authorities under the Defence of the Realm Regulations worked out at about 14 to the acre, or about 11½ rods each. The larger type enabled the labourer to feed his family during the period of lowest wages, but at a great expense of personal labour. Such allotments, although they rendered low wages possible, were no help to agriculture as a whole. For the last 80 years the labourer has been trying to better his position, and an

allotment has been his best support in the struggle. While he retains it he has always some alleviation of poverty, and his personal interest in the land can never be so small as it was in the opening years of the 19th century, when the movement may be said to have taken definite shape.

The history of small allotments is more difficult to trace, but these allotments certainly took their origin in the 19th century, at the time of the development of the industrial system and the growth of towns. Practically all were provided by private enterprise between 1830 and 1840. It was not until 1887 that public authorities obtained powers enabling them to acquire land and let it in allotments. The Small Holdings and Allotments Act of 1908 constituted the Board of Agriculture the central authority for all such allotments. The greatest extension came during the War, in 1916, after the threat of scarcity had been fully realised. While it is difficult to estimate exactly the total number of allotments in the country, the estimated figure for 1918 was 1,400,000 allotments in being. The number at present has been put as high as 1,750,000, but official returns, not yet completely tabulated, would indicate a number more closely approaching 1,000,000. The best results are shown by Buckinghamshire, Cambridge, Northampton, Oxford and Leicester, in which counties there is one allotment for every three households in the area. Of the 150,000 acres included in the return, more than 92,000 acres are still provided by private owners, and less than one-half of the land by public authorities.

Sir Daniel Hall proceeded to consider the typical allotment, that is, one of 10 rods or one-sixteenth of an acre. Such a plot can rarely provide all the potatoes and vegetables required for an ordinary small holder. Assuming that it had to provide for a family of 5 persons and that half of the area was cropped with potatoes, the quantity produced would be barely half-a-pound of potatoes per head per day, and the same amount, or rather more, of vegetables. This is, perhaps, a low estimate. On another standard of comparison it was calculated during the War that about 3 acres would provide the necessary potato and vegetable dietary of 100 soldiers per year. Such a dietary required 13 oz. of potatoes and 11 oz. of vegetables per day. On this basis, a 10-rod allotment would provide 2 soldiers with the necessary dietary, or approximately about the requirements of 2 adults and 3 children. The general experience, however, seems to show that the produce of a 10-rod allotment requires to be supplemented at various times of the year in order to meet the demands of an average family. It

would yield produce valued at about £9 in the official retail market, of which £3 must be deducted for cost of land and working generally. The plot is, however, a substantial economic contribution to a household budget, and brings about a marked decrease in the national food bill if the number of allotments is taken at approximately 1,000,000. The allotment, however, does not as a rule yield as much as it might easily be made to do, and presents a great opportunity for increased production by more intensive cultivation.

A system of cropping* worked out by the officials of the Food Production Department was described. Sir Daniel Hall next dealt with the question of fertilisers, and emphasised the importance of maintaining sufficient humus, especially on the London clay. He advocated the keeping of some small live stock upon the allotment. This is impossible on 10-rod allotments, while on town allotments, where the owner lives at a distance, live stock could not be protected. The ideal is to have enough land on which to keep a pig. Rabbits are valuable as consumers of otherwise unedible produce and as providers of food and manure. There remained the very vexed question of tenure. No adequate solution is at present possible. With building land close to our towns at its present price, it seems as if the allotment areas must continually shift on to land not yet ripe for building. It should not, however, be impossible to ensure that no large schemes of building will be sanctioned in future, unless they provide a reasonable allowance of allotment land.

In the third lecture, Sir Daniel Hall discussed certain points which, in modern conditions of life, give a peculiar value to the food grown on allotments. He touched upon the chemical composition of food, dealing with the fat and carbohydrate constituents which supply the main source of energy; the proteins which supply the waste of tissues; and the mineral salts, which are necessary to build up bone and to form part of the constituent of blood. While these constituents alone can be summed up as food, recent investigation has shown that there are other necessary elements in diet without which life cannot be maintained. The addition to essential constituents of a minute quantity of certain natural foods, such as milk, immediately makes chemically-prepared food useful to the animal, enabling it to thrive and to reproduce its kind upon the experimental diet. Of these essential elements, insignificant in amount, the action is not yet understood. They

* The scheme is explained in a Leaflet (No. 315) recently issued by the Ministry. The system of cropping was also illustrated in a chart published on p. 83 of the issue of this *Journal* for April, 1920.

may be termed the keys to the doors of the otherwise closed food stores. These substances have been called *vitamines*, but it is preferable not to speculate about them and to call them simply accessory food factors. Of these, three at least have been distinguished:—(1) the so-called fat-soluble factor, promoting growth and preventing rickets in young animals and maintaining health in adults; (2) the anti-neuritic factor, in the absence of which disease like *beri-beri* occurs; (3) the anti-scorbutic factor, that guards against scurvy.

The important feature of these *vitamines* is that although they occur more or less in certain animal foods, they are manufactured only by living plants. They have the power of keeping off "deficiency" diseases, such as rickets, imperfections of teeth and certain skin diseases. Hence one of the great values of the allotment, especially where conditions of food supply are difficult, is that it provides all classes of the community with sufficient material rich in *vitamines*. But for the allotment, these essential elements might be hard to obtain, and it is to be feared that before the War they were abnormally short in the diet of many classes of the population.

The benefits of the allotment to the community from a purely social point of view were next emphasised. The individual can never be satisfied with purely passive amusements; he must be an active participant in the game. There is no more deeply-seated desire or delight than that which men associate with growing things, and this primitive instinct finds its highest expression in the fancier's pleasure of introducing specially beautiful or finely-developed specimens. In this he realises the joy of the creator and artist. This touch of nature was well exemplified in the early years of the 19th century by the working-men florists of the northern and midland manufacturing towns. It is unfortunate that they are dying out, for to their efforts we owe the most beautiful varieties of carnations, tulips, chrysanthemums and pansies, and also the best varieties of gooseberries.

The growing of flowers, fruits and vegetables, the quickened interest of competitions, made life very real and vivid, and lent a glimpse of poetry and nature-worship to men whose lot was otherwise cast in grey and even sordid surroundings. Similarly, the growth of the allotment movement will once again provide the majority of men with a plot of land they can call their own, and will not only put them in a sounder economic position and help to ensure the health of their families, but it will also provide an indispensable element of active and stimulating interest in life.

SOME FEEDING EXPERIMENTS WITH DRIED BLOOD.

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VERY considerable quantities of blood are available daily in the abattoirs and slaughterhouses of Great Britain. The blood is collected in pans or allowed to drain away into a collecting gully. In some of the smaller slaughterhouses the blood is either wasted or used for manure, as only a small amount is obtained daily. In the North of England some of the public abattoirs collect blood for the production of serum and for the manufacture of "black puddings," etc.

The quantity of blood potentially available for these purposes may be estimated from the fact that about 30 lb. are obtained when a bullock is slaughtered, and during the years before the War about 3,080,000,000 lb. of meat per year was home-killed.

In recent years several firms have placed dried blood on the market as an animal food, and considerable claims have been made as to the value of this preparation when used as part of a fattening animal's rations. A certain amount of dried blood is thus available as a food for animals, and during the War the difficulty of obtaining nitrogenous foods, especially for pigs, but also for other animals, led to a number of inquiries as to its value and safety as a nitrogen-supplying form of diet. It was, therefore, considered desirable by the Food Investigation Board to institute a series of trials in which blood was the main source of nitrogen, with the object of obtaining data as to its value. The two ordinary grades of blood obtainable are (1) blood dried immediately after collection, and hence free from objectionable odours or decomposition-products; and (2) blood collected in small lots and stored before drying. The second grade is only suitable for manure, while the first is on sale as an animal food. As fresh blood can always be obtained at the larger abattoirs in quantity and dried down immediately, a constant supply is obtainable, limited only by the output from the drying plants.

Dried blood, when properly prepared, is a dry powder with little smell, a pleasant meaty taste, and a salt flavour, and is quite different from the fresh clots of blood which are sometimes

fed to pigs together with such offal as the "manifolds" or third stomachs of sheep and oxen, where proximity to a slaughterhouse allows purchase in a fresh condition.

A series of experiments was, therefore, designed to test the value of dried blood as an addition to ordinary carbohydrate diets, and also to ascertain how far it could be used to supplement the deficiency of a single foodstuff unsuitable by itself, either owing to lack of nitrogen or to absence of accessory food factors.

Feeding Trials.—A number of trials have been carried out by different investigators on dried blood, and the results have indicated that it possesses considerable food value when added to a mixed diet, but it was decided to restrict the experiment to the effect of blood as an addition to a carbohydrate diet. For this purpose two series of experiments were arranged:

- (1) Blood as an addition to maize meal.
- (2) Blood as an addition to wheat offals.

Some experiments on the addition of casein to maize meal are recorded in *Amer. Jour. Bio. Chem.* (Vol. xxix., Part 3), maize + casein + salt mixture and maize + germ being tried against maize + salt mixture only. In these trials three animals in each lot were fed for a period of 180 days, with the following results:—

Maize + casein + salt mixture :	average gain	179 lb.
Maize + germ	.. .. "	119 "
Maize + salt mixture only	.. .. "	12.3 lb.

These results indicate an extraordinarily low value for maize as a single food, and it was thought that a basal diet of maize would allow any effects of added blood to be clearly seen. It has also been stated that the addition of blood to an ordinary diet not only caused a greater increase in the live weight of blood-fed pigs than would be expected from its food value, but also that the proportion of the carcass to live weight was greater than that in animals fed in the ordinary way. It was therefore decided to follow the pigs through the slaughterhouse and to ascertain the dead-weight proportion of the animals as well as the gross increase during the course of the experiment.

Twenty-eight pigs were selected and divided into four lots of seven pigs each, each lot being arranged to average, as nearly as possible, the same total live weight. Each included two "large white," one "large black" and four cross-bred pigs, so that a fair average on such animals as are used in ordinary farming practice could be obtained.

Experiment I.—The pens of seven pigs were fed as follows:—

- Lot I. received wheat offals only.
 " II. " maize meal only.
 " III. " wheat offals and dried blood.
 " IV. " maize meal and dried blood.

In addition, each pig received $\frac{1}{2}$ oz. bone meal daily.

The amount of blood fed to each pig in Lots III. and IV. was 2 oz. per day to begin with, rising gradually to 6 oz. per pig per day, an average of 4 oz. per day; an extra 5 lb. per pen was allowed so as to bring the total to 1.25 cwt. in all for both lots of blood-fed pigs. It took two or three days before the pigs tolerated the blood, but after they became used to the mixture they took it willingly, and apparently liked the taste.

The blood used was a mixture of equal parts of blood supplied by two different firms. The two samples were rather different in composition, as shown by the following analyses:—

		Percentages.	
		A	B
Water	.. ..	7.27	8.30
Ash	.. ..	8.60	3.63
Protein (N \times 6.25)	.. ..	50.00	82.78

It will be seen that the samples varied considerably in composition, as A was whole blood while B was partly clot from serum production. Both, however, were well dried, free from smell, and finely divided.

Each lot of pigs received altogether 1.25 cwt. of blood during the eleven weeks of the experiment, and the corresponding pen had a weight of maize and offal added to make up an equal total weight of ration. During the last fortnight but one the pigs in Lot IV. received 28 lb. more maize than those in Lot II. and 112 lb. more during the last fortnight, as it was obvious that they were needing an extra ration. In the other cases, however, the total weights of food given were similar. Lot II. occasionally refused food, and 37 lb. of maize in all were weighed back and carried on to the next meal, when an equal amount was deducted from the weight of food fed at that meal.

During the experiment the ration was fixed by the maximum which could be fed to the control pens. In both diets the blood-fed pigs were much livelier and more hungry than the controls, and had the former been on an *ad lib.* diet they would have taken much more food than the controls.

It was originally hoped to keep the nitrogen ratio constant by substituting pure starch for some of the maize and offal in the blood-fed lots, but this was found to be impossible in practice, owing to the difficulty in obtaining starch in sufficient quantity, and it is not in accordance with farming practice

to use pure nitrogen-free starches for farm animals. The object of the experiment was to demonstrate the use or value of blood as an addition to ordinary agricultural foods.

The composition of the offals and maize used was as follows:—

	<i>Maize Meal.</i>		<i>Wheat Offal.</i>	
Water	12.81	....	12.62	
Ash	1.12	....	4.53	
Protein (= N × 6.25)	9.37	....	14.30	
Fibre .. ..	.60	....	9.60	
Fats	3.26	....	4.16	
Carbohydrates..	72.84	....	55.99	

These were supplied through the ordinary channels; the maize was of good quality, well-ground and in good condition, but the offals were of somewhat inferior quality, especially in comparison with pre-war standards. Different bags varied somewhat in appearance, so that three were kept in use at a time and the ration made up by mixing the contents to ensure as far as possible an even quality from day to day.

The pigs were weighed at weekly intervals, and after 11 weeks' feeding gave the following total results:—

Lot.	<i>Weight at start.</i> lb.	<i>Weight at finish.</i> lb.	<i>Gain or Loss (—).</i>		<i>Value of Gain or Loss (—).</i>	
			lb.	s. d.	£	s. d.
I. ..	381½	600	218½		11	7 0
II. ..	409½	406	—3½		—0	3 0
III. ..	402½	686	283½		14	18 0
IV. ..	415½	623	207½		10	18 0

The pigs in Lot II. showed very little appetite, and after a week or two took their ration of plain maize meal only with eluctance and when pressed by hunger. As will be seen from the table, they put on no weight and rather fell off in condition, so that it was not considered advisable to continue the diet. Lots I. and III. were continued on their diet until they weighed about 1 cwt. (porker), so that it would be ascertained whether the use of blood gave a greater proportion of carcass to live weight than wheat offals only.

Lot.	No.	<i>Live weight.</i>	<i>Carcass weight.</i>	<i>Plucks.</i>	<i>Entrails.</i>
		lb.	lb.	lb.	lb.
I.—(i) ..	120		80	4	17
I.—(ii.) ..	136½		88	6	14
I.—(iii.) ..	120½		81	5	14
I.—(iv.) ..	120		84	4	12
III.—(i.) ..	131		85	6	18
III.—(ii.) ..	138		93	6	15½
III.—(iii.) ..	115		78	4	14
III.—(iv.) ..	108		71	4	16
III.—(vii.) ..	119		94	5	13
IV.—(i.) ..	125½		88	4	13
IV.—(v.) ..	121		83	4	11
IV.—(vi.) ..	124		79	5	14

Experiment II.—It was then thought that the addition of a small amount of fresh vegetable food, such as is often given to pigs on farms, might possibly affect the general metabolism of the animals. The pigs in Lot II. were divided into two pens, and one pen received a single kohl-rabi plant per pig per day, in addition to the diet, for another period of four weeks. The results are shown in the following table. The same procedure was adopted with the pigs in Lots I., III and IV., where two of the pigs not intended for slaughter were given kohl-rabi and tried against two on a continuation of the experimental diet.

	Weight at start. lb.	Weight at finish. lb.	Gain or loss (-). lb.
<i>Lot. I.</i>			
A. no kohl-rabi	153	199	46
B. kohl-rabi ..	156½	212½	56
<i>Lot II.</i>			
A. no kohl-rabi	173½	160	-13½
B. kohl-rabi ..	176½	191	14½
<i>Lot. III.</i>			
A. no kohl-rabi	185	240	55
B. kohl-rabi ..	186½	238	51½
<i>Lot. IV.</i>			
A. no kohl-rabi	134½	105½	1
B. kohl-rabi ..	115	153½	35

The experiment was then discontinued. The kohl-fed pigs in Lot II., receiving maize meal, improved considerably in health, became lively, and took their food with much greater relish. The control pigs on maize meal alone still refused their food and made a slight loss in weight.

In Lot IV. the pigs receiving no kohl-rabi did not increase in weight, but were quite lively and in fair general condition. The seventh pig in Lot II. was taken out of the second part of the experiment as he had injured his leg against the feeding-trough. He was placed by himself and given an *ad lib.* ration of fresh mangolds in addition to maize. In three weeks he had doubled his weight from 35½ lb. to 84 lb. During the period of feeding with kohl-rabi the maize-fed pigs were given an *ad lib.* diet, but they did not take more than they had done during the course of the first experiment.

Conclusions.—The results obtained indicate that the addition of blood to an ordinary farm ration of wheat offals may cause a very considerable gain in weight compared with the results obtained from a farm diet of offals only, while the addition of blood to plain maize meal may give an increase equal to the results obtained from feeding offals only. The results obtained

on maize meal alone compare exactly with those obtained by the American observers who undertook the experimental work of feeding maize to pigs as a comparison with maize + casein.

The addition of a small quantity of fresh vegetables to the diet showed a very considerable gain against an ordinary ration, but their use appeared to be unnecessary when a full diet of wheat offal plus blood was fed. It is, however, recognised that this part of the experiment is tentative only and requires a further trial with at least seven pigs in each lot before any definite conclusions can be arrived at.

The results are recorded, as the pigs were in such a suitable condition (*i.e.*, used to the diet) after 11 weeks of experiment as to justify the trial even on two or three animals.

The cost of dried blood is fairly high, but it must be remembered that only a few oz. should be fed daily, or an excess of nitrogen in the diet would result, and this is undesirable. In these trials the total cost of the blood was as follows:—

1.25 cwt. blood per *pen* at 18s. 6d. per cwt. = 23s. 1d. per *pen* for Expt. I.

20 lb. blood per *pig* at 18s. 6d. per cwt. = 3s. 4d. per *pig* for Expt. I.

The thanks of the writer are due to the Food Investigation Board, who provided the costs of the experiment, and to Professor T. B. Wood and Professor Hopkins of the Animal Nutrition Institute, Cambridge University, for permission to use their laboratories and Nutrition Station and also for much assistance and advice.

THE STUDY OF RURAL ECONOMY AT OXFORD.

S. L. BENSUSAN.

SOME time in the days when the star of the first Napoleon was in the ascendant, and nearly ten years before Great Britain, by her victory in Trafalgar Bay, assumed the hegemony of the seas, Professor Sibthorp founded in Oxford and endowed a Professorship of Rural Economy. Through the century that followed the study languished in the absence of urgent need, but when Time gave birth to conditions that demanded change, the means of bringing it about were to hand. The outstanding question would appear to have been one of detail rather than of principle, for when the authorities at Oxford decided to interest themselves anew in agricultural work, they were faced by several difficulties.

In the first place, Cambridge had already taken up the purely scientific side of agriculture and was engaged on successful work of national importance. The study of agriculture on modern lines was the keynote of the work at University Colleges like Wye and Reading, and it might have seemed at first that, without duplicating either the research of Cambridge or the technology of the leading farm-schools, it was well-nigh impossible to find a field for service. Fortunately, Oxford surveyed the outlook "with a dilated eye." It was seen that while much work of great importance was in progress elsewhere for the benefit of men of science and those who proposed to follow high farming, nothing was being done deliberately, and in pursuit of a well-considered programme, for those land-owners who have for centuries been the upholders not only of agriculture, but of a great rural tradition, men whose sons, generation after generation, find their way to the University.

At a Conference held in 1916, and attended by Lord Selborne, Lord Ernle, the Master of Balliol, Sir Daniel Hall, and others, a scheme was devised to give the future landlords of Britain a training, practical and theoretical, that will do more than merely fit them to take intelligent oversight of their tenants' acts of husbandry. It will enable them, if they are prepared to shoulder the heavy burden of their responsibilities, to turn their home farm into a model farm for the district; a holding on

which the latest methods, the newest machinery, and the most efficient management may be studied by all who are concerned to make the best of their opportunities. This does not exhaust present needs. The questions before the landlord to-day are many and varied. Quite apart from farming on the best lines, he must understand organisation, costs, transport, rating reform and co-operation. The history of English land and of English landlords, and the curious complicated story of Local Government, are also matters that should concern him, and he must learn, too, to discover the most profitable farm unit for his estate, whether it is the small holding up to 50 acres, the large farm of over 500, or whether some special circumstances make it possible for him to tread in comparative safety the ground that lies between.

The *Schola Oeconomiae Rusticae* is firmly established to-day in Parks Road, Oxford, on land belonging to St. John's College, which shares with Balliol the honour of having given wise and generous support to the new movement. The Institute for Research in Agricultural Economics, of which Mr. C. S. Orwin is Director, is housed in the same building, which was completed in 1914, and is adequately equipped for the work in hand. The present Sibthorpian Professor and Head of the School is Dr. Wm. Somerville, of St. John's, the eminent agriculturist whose experiments at Poverty Bottom Farm in Sussex went far to prove that there need be no such thing as infertile soil in England. His later work on the renovation of our 15 million acres of English and Welsh pastures, most of which stand so sorely in need of repair, is too well known to need comment. The Lecturer on Agricultural Chemistry, Mr. C. G. T. Morison, of Balliol, is responsible, with Mr. Orwin, for much of the administrative work in connection with the school because at the present time the Colleges, with the single exception of University College, have no tutors in Rural Economy, and this lack, which it would be hard to remedy just now, has imposed upon a small band of devoted teachers a very extensive round of work for which time must be found when the duties of a normal day have been accomplished.

In connection with the School of Rural Economy, the Temple Farm at Sandford, about three miles south of the city, provides for all practical demonstration. The farm with its old Tudor house and pleasant avenues has more than purely agricultural associations. It was a home of the Knights Templars, and Sandford holds still its faint but pleasant memory of Mathew Arnold, one of Oxford's most loyal sons in the mid-Victorian

time.* Temple Farm is the property of Magdalen College, and consists of about 120 acres of arable, including some that looks to be heavy and unpromising, and upwards of 200 acres of grass, of which about one hundred are kept for hay. There is a dairy herd of about 25 Shorthorn cows, for which it is claimed that they are among the most productive on the books of the Oxfordshire Milk Recording Society, and practical demonstrations are in the good hands of Colonel W. R. Peel, M.A., D.S.O. Those who follow Colonel Peel's sound and attractive lectures are safe, *experto crede*, to have their attention directed to all the salient points of practical farming. The farm accounts are strictly kept. They are analysed, and income and expenditure are apportioned to their proper departments. The farm enjoys a special advantage from the proximity of the Oxford Steam Plough Company, of which the depot is only a mile away.

Perhaps it is a little late in this paper to point out that the University of Oxford now gives a degree in agriculture, the B.A., which may be taken "with distinction." The student must keep his nine terms and join a College or the Non-collegiate body. He must pass Responsions and follow the regular course of examination towards a degree, but begins his study of Agriculture from the day he enters into residence. It is unnecessary to deal here with these examinations further than to point out that those who succeed in satisfying the examiners will have a competent knowledge of the economics and history of agricultural production, distribution, organisation, farm and estate management, and agricultural law, while they may add to it elementary physics, chemistry, zoology and botany. To meet all fees and to maintain himself at Oxford it is estimated that the present cost to a student is about £250 a year.

This effort to bring agricultural education into line with the general tutorial system of Oxford, this grant of a degree in agriculture which, it is well to remember, is the highest of its kind in England, shows that Oxford, for all its aloofness from the stress and turmoil of normal times, is in close touch with the needs that these times have brought to birth. Some of us may, perhaps, be pardoned for believing that this stone which the builders have so long rejected may become, if not the headstone of the corner, at least one of the really essential supports of the greatest educational institution our civilisation has yet evolved. The organisers of the movement are no mere dreamers. Their

* "I know what white, what purple fritillaries
The grassy harvest of the meadow fields
Above by Ensham, down by Sandford, yields,
And what sedged brooks are Thames's tributaries."

vision of a regenerated England is no baseless fabric. Dr. Somerville, while admitting the immense possibilities of the School, which he has done so much to establish, deals steadily with hard facts. There are 26,000,000 acres of cultivated or cultivable land in England and Wales, and he holds that a 20 per cent. improvement is possible. On much of the grass land he looks to see a double quantity and a double quality of production, so that where two sheep are grazing to-day, four sheep may graze in seasons to come, each doing twice as well as its predecessors. Dr. Somerville is taking nothing for granted, and many old theories of production are being put to a searching test. For example, he finds that on some soils for which lime is recommended as a cure for sourness, lime alone does not pay, and that a phosphatic manure must be added. The spirit of inquiry, and the infinite possibilities that may follow wise experiment, may, perhaps, account in part for the fact that in the School of Agriculture and the Forestry School there are now upwards of 200 students, including five women, and there are few, if any, Colleges in Oxford at which it is not possible to find some students who hope to take their degree in agriculture.

The Institute for Research in Agricultural Economics was established by the Development Commission through the Ministry of Agriculture, and in spite of the extraordinary difficulties that beset the keeping of farm-accounts, particularly when an effort is being made to establish costs of cultivation, Mr. Orwin can make out a very strong case for work on certain definite lines. The Institute has already conducted inquiries into costs of production, the agriculture of three counties (Oxfordshire, Berks and Northants), the economic aspects of small holdings and allotments, the expenditure on labour per acre, and transport problems. It will never be possible to state costs of production in terms of England and Wales, or in terms even of a great part of either without doing injustice to the majority of those concerned, because these costs naturally vary in accordance with the nature of the soil, the method of cultivation, the competence or incompetence of the farmer, the state of the weather, the difficulties of transport, the cost of feeding stuffs and artificial manures, and a host of other questions that must occur to any man who has ever looked, even to a few fields, for a return on his outlay and endeavour. The question of the production that is best for a district is, however, one that belongs to economics.

It is possible to establish definitely the production per man and per acre in any given area, and, eliminating the human

factor, to draw really valuable conclusions as to the type of management and size of holding that will pay best in a district that has been carefully surveyed. Cost accounts are individual affairs, but they enable the farmer to learn what *his holding costs him in food, labour, management, transport and the rest*. Costing enables him to select the crops that will pay and the stock that is worth keeping, and to leave the others alone, and while deciding where it is better to grow the material for production, such as hay and roots, for example, to sell it to those who will provide the finished article in the form of beef and milk. Clearly the cheapest source is the proper source, and the School of Rural Economy is in a position to decide beyond all possibility of doubt the question of cheapness. It can bring large things and small into the region of proof, and a striking example of the latter class is provided by the question of overtime. Certain farmers think it does not pay to give overtime, but those who have been in touch with the School of Rural Economy at Oxford know better, for it has been pointed out to them that when their workers go home because the farmer will not pay overtime, he must support his horses in idleness, at a cost (net loss) which might be converted into a profit if he considered the question of overtime in all its bearings.

It may be suggested that the new School of Agriculture at Oxford, youngest and not least vigorous branch of that venerable Tree of Knowledge, is designed, despite its particular purpose, to serve all classes of the agricultural community, from the owner of many acres down to the actual tiller of the soil. Farm costings, from which some of us, with the best intention in the world, cannot help shrinking, are of more than passing value, because by their aid the farmer will be able to decide within a little the return that agricultural produce in this country is capable of making. On this solid basis it will be possible, beyond the shadow of a peradventure, to decide what wages a rural industry can pay and what difference in its capacity to pay will follow from enlightened methods, to the fruition of which landlord, farmer and farm labourer, have given their best, united endeavour.

THE COMPOSITION AND FEEDING VALUE OF SILAGE.

THE steady extension of the practice of ensilage in this country in recent years has made it desirable that the meagre information hitherto available as to the composition and feeding value of silage should be supplemented as far as possible. The older analyses can hardly serve as a reliable guide to present-day practice, in view of the greater variety of crops and the improved methods of preparation now used.

With a view to initiating the collection of reliable data arrangements were made by the Food Production Department in 1918 for obtaining from various sources samples of silage made in 1918-19. The analysis of 17 samples was kindly undertaken by Mr. Gwilym Williams, of the School of Agriculture, Cambridge, and his results are summarised on p. 280. Estimates of the relative feeding values are also given, these estimates being based upon the composition and digestibility of the materials.

Moisture.—Attention may be directed first to the fact that there was great variation in the proportion of moisture in the 17 samples (ranging from 58·4 per cent. to 81·62 per cent.); and conversely to the percentage of dry matter (ranging from 41·6 to 18·38 per cent.). The highest percentage of moisture (81·62) is accounted for by the fact that this sample was a maize silage, the thick, fleshy stems and leaves of this crop inevitably carrying a large proportion of water into the silo. The three driest samples were all from one farm, and it would seem that either the crop was allowed to ripen to an appreciable extent before cutting, or was dried somewhat before transferring to the silo.

Apart from these four samples the percentages of moisture are distributed fairly uniformly between the limits of 67 per cent. and 78 per cent., which may, perhaps, be regarded as the normal range of variation, with an average in round figures of 73 per cent. moisture, or 27 per cent. dry matter.

Albuminoids or Protein.—The albuminoids (or protein) of feeding stuffs always possess a special importance, since they have certain bodily functions to sustain which no other ingredient can support.

In some analyses a distinction was made between "crude albuminoids" (or crude protein) and pure albuminoids (or pure protein). The former represents the total nitrogenous

matter of the silage, while the latter indicates how much of this is real albuminoid material. The difference (commonly referred to as "amides") represents nitrogenous ingredients which, though not without value to the animal, do not possess the full virtue of the true albuminoids. These "amides" are always present to some extent in the greenstuff as it goes into the silo, but the fermentation processes which take place there tend to increase the proportion of "amides" at the expense of the true albuminoids. Consequently, so far as the feeding efficiency of its nitrogenous matter is concerned, the silage is somewhat inferior to the green fodder from which it is made. In the nine cases where the separate determinations were made the pure albuminoids formed from 50 per cent. to 81 per cent. of the crude albuminoids.

The point is probably not of serious practical consequence, however, since the silage will commonly be fed as part of a mixed diet, the other ingredients of which can be made to ensure an adequate supply of albuminoids.

Carbohydrates and Fibre.—The feeding value of silage in a mixed diet will be chiefly determined by its content of digestible carbohydrates and fibre. The loss due to fermentation in the making of silage falls more heavily upon the carbohydrates than the fibre, so that the proportion of the former is somewhat lower than in the original green fodder. The proportion of fibre is consequently increased, but it is probably rendered more digestible by the fermentative action. With the exception of a *Trifolium* silage, the proportion of carbohydrates was appreciably higher than that of fibre.

Relative Feeding Value of Silage.—In order to obtain an estimate of the feeding values of the various silage preparations as compared with each other and with roots and hay, respectively, the "starch equivalent" method of assessment was used. For the purposes of this method it is necessary to know not only the composition, but also the digestibility of each material. In the case of these silage samples, however, there was no information as to their actual digestibilities, and, consequently, it has been necessary to assume the same digestibility for each, this being taken as the average digestibility of oat and vetch silage given in published tables of digestion co-efficients. As there was no means of knowing how far this assumption may have been valid, the estimates of feeding value arrived at can only be regarded as rough approximations.

The feeding values were expressed as "maintenance starch equivalents," the figures representing the number of pounds

of starch which, in a mixed diet containing an adequate supply of albuminoids, would have the same value for simple "maintenance" purposes as 100 lb. of the silage. Taking these figures as the basis, and the corresponding "maintenance starch equivalents" for roots and hay of average quality, the data given in the last two columns of the table are arrived at.

In this connection it may be pointed out that although silage in farm economy and feeding practice serves commonly as a substitute for root crops, its only outstanding resemblance to roots in feeding properties is its succulence. It is more fibrous and less digestible than roots, and in chemical composition, apart from its high moisture-content, resembles the hay that might alternatively have been made from the original green fodder.

The estimated "starch equivalents" range from 10.3 per cent. for the maize silage to 23.3 per cent. in the case of a lucerne and seeds second-crop silage. The value in terms of roots ranges from 1.12 to 2.54 tons of roots per ton of silage, while in terms of hay the range is from 2.1 to 4.76 tons of silage equal to 1 ton of good hay.

The wide range of variation thus indicated is due more to the great differences in moisture-content of the silages than to intrinsic differences in the feeding value of the actual nutritive matter. If the silages are reduced to a comparable basis of 70 per cent. of moisture (or 30 per cent. of dry matter) the range of variation in starch-equivalent is only from 15.5 per cent. to 17.8 per cent.; that is, the best is only about 15 per cent. better than the worst. In view of the assumptions underlying these estimates it will be safest to conclude that, so far as chemical analysis can furnish guidance, the various silages had substantially the same feeding value apart from the variations in moisture-content. This conclusion only holds good if the silage is fed in a mixed diet which supplies sufficient albuminoids for the needs of the animal. If the albuminoid supply were scanty the silages containing the higher proportions of albuminoids would have a higher intrinsic value than they are credited with in the above estimates.

Assuming 30 per cent. of dry matter, the average "starch-equivalent" for the 17 samples is 17.05 per cent. One ton of such average silage would be equivalent for "maintenance" purposes to 1.85 tons of roots; or 2.87 tons of silage would be equivalent to 1 ton of good meadow hay. These figures bear out closely the opinion expressed by Mr. Arthur Amos

Analyses of Silage carried out at Cambridge for the Food Production Department in 1919.

No.	Nature of Sample.	Water.	Fat (Ether Extract).	Crude Albuminoids (Or Crude Protein).	Carbo- hydrates.	Fibre.	Ash.	Pure Albuminoids (Or Pure Protein).	Maintenance Starch Equivalent.	Tons Roots Equivalent to 1 Ton of Silage for Maintenance.	Tons Silage Equivalent to 1 Ton of Meadow Hay for Maintenance.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Tons.	Tons.
1	Grass, Tares and small quantity of Oats	66.17	1.20	5.01	18.82	11.06	3.74	3.24	22.8	2.48	2.75
2	Tares and Oats ..	62.27	.98	4.43	17.90	11.59	3.08	2.93	21.7	2.36	2.26
3	Turnip and Swede and Crop ..	58.40	2.17	6.02	15.70	13.59	4.77	2.48	17.2	1.82	2.58
4	Turnip and Swede and Oats ..	67.37	1.01	4.55	12.61	13.22	4.70	3.92	17.9	1.94	2.75
5	Clover ..	81.62	1.37	3.25	6.93	9.45	2.95	1.79	10.3	1.12	4.76
6	Maize ..	70.13	2.53	3.92	10.28	18.96	2.18	2.41	17.5	1.90	2.80
7	Trifolium, Rye and Marsh Grass	74.80	1.57	3.84	11.30	18.50	2.19	1.86	16.4	1.78	2.99
8	Oats and Tares ..	72.30	2.07	3.63	11.39	8.62	2.19	1.86	16.4	1.78	2.99
9	Grass ..	74.53	.97	3.53	8.90	7.93	4.08	1.85	13.15	1.43	3.72
10	Clover ..	78.50	1.53	2.31	8.98	5.65	2.43	—	12.4	1.35	3.95
11	Grass, Oats, Rye, Beans and Wheat—all	72.13	1.56	3.27	12.89	8.21	2.24	—	16.3	1.77	3.01
12	Turnip, Swede, and Clover ..	74.70	1.34	3.73	8.99	9.05	2.21	—	14.2	1.54	3.46
13	Trifolium ..	72.70	1.55	3.80	10.16	10.34	1.75	—	15.55	1.69	3.15
14	" (and Sample) ..	72.70	1.55	3.80	10.16	10.34	1.75	—	15.55	1.69	3.15
15	Rye, Oats and Tares ..	72.83	1.19	3.36	8.84	8.40	1.90	—	16.45	1.79	2.88
16	" ..	72.83	1.19	3.36	8.84	8.40	1.90	—	16.45	1.79	2.88
17	Clover ..	73.50	2.45	3.44	10.71	7.67	2.43	—	15.75	1.72	3.11
									Average ..	1.78	3.13

in his recent address to the Farmers' Club.* "Taking into account the chemical analyses and the feeding experiments I am of opinion that 3 lb. of oat and tare 30-per-cent. silage may be regarded as having a value slightly greater than 1 lb. of good oat and tare or clover hay, and that 1 lb. of oat and tare 30-per-cent. silage is equal to slightly less than 2 lb. of roots. . . ."

In conclusion, it must be borne in mind that chemical composition, although the most important, is not the only factor determining the nutritive value of feeding-stuffs. The physical condition, palatability, etc., must also be taken into account; these factors will doubtless in actual practice have given rise to greater differences in the values of the respective silages than are indicated by the above estimates.

* Contributed to the *Journal of the Farmers' Club* in 1920.

POTATO SPRAYING TRIALS IN THE CAMBRIDGESHIRE FENS, 1919.

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THE experiments dealt with in this article are a continuation of those started in 1918, an account of which appeared in this *Journal* for January, 1919.

They were carried out on two fields lent by Mr. F. Hiam (Putney Hill Farm, Prickwillow), who bore the cost of the labour connected with the experiments.

The work for the year was planned to form part of the trials on the effect of spraying over a series of years, and also to find out if machines applying over 200 gal. per acre are likely to be more profitable than those at present on the market which apply about 100 gal. per acre.

The season of 1919 was an exceptional one from the point of view of potato blight. There can seldom have been a season in which blight did less damage. The fact that Up-to-Dates, planted in April on a gravel soil near Cambridge, were dug in October free from blight will serve to show that this disease had practically no effect on the yield of late varieties in this district.

Blight was first found at Prickwillow in a field of Eclipse on July 28th, and here it spread slowly until the lifting was finished on August 10th. On the experimental plots "blight" was found both on the Majestic and Evergoods on August 1st, but throughout the season it spread slowly, so that it was not possible until the middle of September to find more than a slight trace of it on the haulm. Growers would have regarded these plots as free from blight until the middle of September.

The Spraying.—The mixtures used were as follows :—

(1) *One per cent. Bordeaux Mixture.*—This was made in a 40-gal. tub. In the tub 4 lb. of copper sulphate were dissolved in about 30 gal. of water. As Buxton lime was not obtainable, ordinary builder's quick-lime was used : 2 to 2½ lb. of Buxton lime is usually sufficient for 4 lb. of copper sulphate, but more than this quantity of the builder's lime was used. It was slaked in a large bucket, and then made into a milky solution by the addition of water, and after settling was poured through a sieve covered with coarse sacking into the copper sulphate solution. The mixture was then well stirred and lime water added until no brown colour resulted with the potassium ferrocyanide test. Water was then added to make up the 40 gal.

(2) *Two per cent. Bordeaux Mixture*.—This was made by using double the above amounts of copper sulphate and lime.

(3) *One per cent. Burgundy Mixture*.—This was also made in 40 gal. tubs, 4 lb. of copper sulphate being dissolved in about 30 gal. of water; 5 lb. of washing soda were then dissolved in about 5 gal. of water and poured into the copper sulphate solution. The mixture was well stirred and water was then added to make up the 40 gal., when the mixture was again stirred. Every tub was tested with red litmus, which turned blue.

(4) *Bordeaux Powder*, bought ready made.

The ordinary spraying machine was of the "cart" type, the tank being formed by the bottom, sides and top of the cart. This machine did 5 rows at once, and at full pressure applied 85 gal. per acre from 3 nozzles per row. A new machine of the barrel type was tested, with a large pump and 5 nozzles per row (25 nozzles altogether), the extra pair of nozzles being 10 in. above the ordinary pair. This machine had a barrel capacity of 120 gal., and applied 200 gal. per acre.

The working of the 5-nozzle machine, with its larger pump, is much harder for the horse, and also has the disadvantage that it has to be filled at each end of the field when the field is over 15 chains long. The cart type of machine is much easier to fill by hand than the barrel type, as the liquid has only to be lifted about 4 ft.

The Bordeaux Powder was applied by means of a "Herrod's Dry Sprayer."

Harvesting.—The potatoes were lifted by means of a spinner, and the produce from each plot was clamped separately.

Field 1.—This field was the same as Field 2 in the previous year's experiments. Its history is as follows:—

1915	..	Potatoes	..	..	10 cwt. superphosphate.
1916	..	Onions	..	..	3 " "
1917	..	Onions	..	..	3 " "
1918	..	Potatoes	..	..	10 " "
1919	..	Potatoes	..	..	20 loads of farmyard manure and 10 cwt. superphosphate.

The variety of potato grown was Evergood (from Scotland), and planting took place early in April. Each plot consisted of 9 rows, 28 in. apart, and was nearly $\frac{3}{4}$ of an acre in area. The potatoes were lifted from 22nd October to 29th October, and were sorted and weighed in January.

At the time of the first spraying the weather was hot and dry, but during the previous week light rain fell on 4 days. The haulms of the potatoes were suffering from a moderate attack of aphis, which got gradually worse during the hot weather which followed the spraying. A few days after the

spraying Plots 9, 10, and 11 showed a fair amount of scorching, and the other sprayed plots showed slight scorching. At this stage the unsprayed plots looked the best.

The second spraying badly injured the haulm of Plot 10, and the damage done was obviously very serious. There was also a moderate amount of scorching on plots 4, 5, and 6. Although a trace of blight was present throughout the season, it did very little damage.

The unsprayed plots continued to look the best throughout the season, and it seemed probable that the spraying had lowered the yield on all the sprayed plots. The following table shows this to have been the case.

Plot.	No. of Spray- ings.	How sprayed.	Yield per Acre.			
			Ware.	Seed.	Blights.*	Total.
			Tons. cwt.	Cwt.	Cwt.	Tons. cwt.
1	1	Bordeaux mixture, 1 per cent., 85 gal. per acre, 25th July ..	9 17.1	10	11.4	10 18.5
2	1	Bordeaux mixture, 1 per cent., 200 gal. per acre, 25th July..	8 17.1	8.5	11.4	9 17.4
3	—	—	10 17.1	7.1	10	11 14.2
4	2	Bordeaux mixture, 1 per cent., 200 gal. per acre, 25th July and 15th August ..	9 8.5	11.4	10	10 9.9
5	2	Bordeaux mixture, 1 per cent., 85 gal. per acre, 25th July and 15th August ..	9 11.4	11.4	10	10 12.8
6	2	Bordeaux mixture, 2 per cent., 85 gal. per acre, 25th July and 15th August ..	9 11.4	11.4	10	10 12.8
7	1	Bordeaux mixture, 2 per cent., 200 gal. per acre, 26th July..	9 10	12.9	7.1	10 10
8	—	—	10 15.7	11.4	10	11 17.1
9	1	Burgundy mixture, 1 per cent., 200 gal. per acre, 26th July..	8 18.5	8.5	5.7	9 12.7
10	2	Burgundy mixture, 1 per cent., 200 gal. per acre, 26th July and 15th August ..	8 13	14.3	7.1	9 14.4
11	1	Bordeaux Powder, 26th July ..	8 18.5	14.3	5.7	9 18.5

* Blights included any potatoes not fit for ware or seed; only a small percentage of these were affected by *Phytophthora*.

† Probably a mistake in the weighings.

It was estimated† that the yield of Plot 2 was equal to that of Plots 4 and 7, so that it seems probable that there was a mistake

in the weighings of this plot. Neglecting this plot, spraying with 1 per cent. Bordeaux mixture once at the rate of 85 gal. per acre (Plot 1) reduced the yield by over 16 cwt. per acre, and spraying twice (Plot 5) with Bordeaux mixture at the rate of 200 gal. per acre has reduced the yield rather more. Spraying with Burgundy mixture at the rate of 200 gal. per acre caused very bad scorching, and reduced the yield by over 2 tons per acre, while dry spraying reduced the yield nearly as much as the Burgundy mixture. (In the case of Evergoods in neighbouring fields, spraying with a patent Burgundy mixture containing copper sulphate and sodium carbonate, in the proportion of 4 parts of crystalline copper sulphate to 4.68 parts of crystalline washing soda also caused bad scorching.)

Field 2.—The history of this field is as follows :—

1915	..	Potatoes	..	..	10 cwt. superphosphate.
1916	..	Potatoes	..	..	10 " "
1917	..	Onions	..	..	2 " "
1918	..	Onions	..	..	2 " "
1919	..	Potatoes	..	..	10 " "

The variety of potato was Majestic (from Scotland). Each plot consisted of 9 rows, 28 in. apart, and was about $\frac{1}{2}$ an acre in area. The potatoes were lifted on 16th–18th October in dry weather, and each plot was weighed and clamped separately. There were few blights, and only a very small proportion of seed. The yields per acre are shown below :—

Plot.	No. of Sprayings.	How sprayed.	Total Yield per Acre.	
1	—	—	Tons.	cwt.
2	1	Bordeaux mixture, 1 per cent. ; 28th July	12	2
3	2	Bordeaux mixture, 1 per cent. ; 28th July and 16th August	11	16
4	—	—	11	10
5	2	Burgundy mixture, 1 per cent. ; 28th July and 16th August	13	4
6	1	Burgundy mixture, 1 per cent. ; 28th July	11	10
7	1	Bordeaux mixture, 1 per cent. ; 16th August	12	12
8	—	—	13	8
			13	16

At the time of the second spraying the weather was duller than when the Evergoods were sprayed. The aphid attack was not nearly so bad as on the Evergoods, and the scorching was much less pronounced. Very little scorching was noticeable with the Bordeaux mixture, but both sprayings with the Burgundy mixture caused scorching.

Blight was present on all the plots before the second spraying, and was much more prevalent on this variety than on the Evergoods. It spread very slowly until the second week in September. Just after the middle of September the unsprayed plots were killed off by blight, whereas the sprayed plots did not die off for some time. On September 18th the percentage of green in the tops was roughly as follows :—

	<i>Per cent.</i>		<i>Per cent.</i>
Plot 1	2	Plot 5	20
" 2	20	" 6	10
" 3	50	" 7	50
" 4	2	" 8	2

Up to that date Plot 5 looked the worst, owing to scorching. Taking the season throughout, Plot 7 looked the best plot.

The above table shows that there was a big variation in the yields of the unsprayed plots. At the time of spraying it was noticeable that the end of the field where the plots started was not so good as where they ended, and as a consequence three control plots were left.

Spraying early with Bordeaux mixture made little difference to the yield as compared with the nearest unsprayed plot. Plot 7 was estimated before weighing to be the highest yielding plot, as there was practically no scorching, and the tops lived longer than Plot 8, which actually gave a higher yield.

It is not possible, however, to account for the low yield of the plot twice sprayed with Bordeaux, as there was little scorching on this plot, and it was expected that its yield would be only slightly lower than that of Plot 4. Plot 5 was expected to give the lowest yield, as the scorching reduced the leaf area.

Conclusion.—The above figures suggest that it is unsafe to spray potatoes in the Fens in a season like 1919. Many growers throughout the Fens scorched the tops by spraying.

After a period of hot, dry weather the leaves of potatoes are liable to attacks of green fly (*aphis*), and under the same conditions are liable to scorch when sprayed. It has been suggested that the scorching is due to the entrance of the spray into the punctures caused by these insects. Until this question is settled by experiments, growers are warned that by spraying in hot, dry weather, when the foliage is attacked by green fly, they risk a loss of crop through scorching.

POTATO LEAF-CURL.

A LARGE amount of careful research work has been carried out during the past few years on Potato Leaf-curl, especially in Holland, but also in Canada, Bermuda and the United States. The results obtained, particularly with regard to the early phases and possibly infectious nature of the disease, are of importance to all potato growers, and especially to those who grow for seed. Though the last edition of the leaflet on Potato Leaf-curl (No. 164) was only issued by the Ministry in 1918, it has been re-written in order that the new results may be incorporated, and in view of the importance of the subject the information it contains should be widely known. The following is the text of the revised leaflet :—

Probably no disease is more responsible than leaf-curl for the weakly potato plants and light crops so often seen, especially in gardens and allotments. In the lighter soils in the southern and drier parts of the country it is very prevalent, and is particularly abundant where the practice of using home-saved seed is followed. There is no doubt that, if its presence were eliminated, an increased yield of several tons per acre would be obtained.

The term "curl" as applied to a malady of the potato has been in use in England for more than two centuries, but it is clear that the older writers included under this name more than one disease. In the present article the name leaf-curl is applied to the disease now generally associated with the deterioration in yield of potatoes, particularly when grown in southern districts, to account for which no fungus parasite has been discovered. It is applied to that form of disease which on the Continent (where it is often very severe) has been called leaf-roll. The designation leaf-roll has also been used occasionally in this country, and is at present used in America. But as the name leaf-curl is well established throughout Britain, and is of long standing, there appears to be no necessity for changing it.

Description of Affected Plants.—The most marked symptom of potato leaf-curl is the curling or rolling inwards of the margins of the leaves (*see* Fig. 1). In mild attacks this rolling is confined to the lower leaves. The curled leaves are thicker and more crisp than in normal plants and give almost a rattle when knocked together. They are usually pale in colour and often die prematurely from the tips backwards. In bad cases the middle and upper leaves are also curled (*see* Fig. 2) and in certain varieties such as President, Midlothian Early and Lochar the whole plant is dwarfed.

The curling of the lower leaves, a feature which has been largely overlooked in the past, is a very important one by which to identify the disease, as it serves to distinguish it from other maladies such as Blackleg and Verticillium Wilt, where the upper leaves only exhibit this tendency.

Leaf-curl is perpetuated by means of the "seed." Its normal course in the southern and drier counties, where it is abundant, is as follows: During the first season that the attack manifests itself (*i.e.*, usually the second year's crop in the south) the lower leaves in a certain number of plants show curl, and there is a reduction in yield in these plants of about 25 per cent. If tubers from such plants are saved and planted the following season, more serious curling will be evident and a further and very serious reduction in yield will occur, most of the tubers being merely of seed size. If these tubers are planted, growth is often a complete failure and the crop almost nil. *The importance, therefore, especially to seed-potato growers, of recognising the disease in its early stages (i.e., during the first year when the lower leaves only are curled) and of rejecting all such plants for seed purposes, is obvious.* Other features of leaf-curl are the failure of the parent "set" to decay, and the tendency for the new tubers formed by an affected plant to cluster round the bases of the stems.

Cause of Leaf-curl.—Though leaf-curl was formerly regarded as being due to a parasitic fungus, it is now known that this is not the case; and by plant pathologists it is generally assigned to the group of so-called "deterioration diseases," its actual cause still being obscure. The symptoms manifested, such as stunting of the growth, curling of the leaves and poorness of crop, clearly indicate that the functions of the plant are not proceeding normally. One important fact has been determined, namely, that much of the food manufactured by the leaves of diseased plants does not pass down to the new tubers as it normally should, but remains in the leaf in the form of starch. Other symptoms of abnormal physiology have been discovered. But whatever the primary cause of these disturbances, the effect is sufficiently great to influence the seed-tubers profoundly, since tubers produced by affected plants give rise to diseased plants the following year. The disease, therefore, may, in a somewhat loose sense, be said to be inherited.

In this country the most commonly accepted explanation of the origin or cause of leaf-curl is that it is due to the use of over-mature seed. Such a condition in the tubers might arise as the result of cultivation in dry soils, particularly in those



FIG. 1.—Potato Leaf-curl. A mild attack showing curling confined to the lower leaves; this is accompanied, however by a decided reduction in crop. Tubers from such plants should not be used for seed purposes, as they will give rise to plants showing the disease in a much more severe form, and with a very poor yield.



FIG. 2.—A more severely attacked plant, showing curling of all the leaves. The yield here is still further reduced, and in extreme cases there is practically no crop at all.

which become unduly warm in summer; or it might be due to a sudden check owing to the occurrence of a dry spell during the period prior to ripening. The fact that seed saved from the southern, drier and warmer parts of England is more subject to leaf-curl than Scotch or Irish seed, as well as the circumstance that curl in the south may sometimes be largely avoided by lifting the crop of tubers for seed before maturity, appears to lend some support to this view. It is believed, however, that these conditions are secondary, and that the primary cause must be sought in an entirely different direction.

The Dutch plant pathologist Quanjier has proved that leaf-curl can be communicated from one plant to another by grafting; and he is of opinion that the disease is due to the presence of a virus which is capable of being inoculated into the plant. Exactly how this infection comes about in nature is not known. Insect bites may possibly carry the virus. In any case it appears that not only does infection take place more extensively in dry, warm climates, but also that infected plants suffer much more severely in such climates than under cooler and more congenial conditions. Further, it appears from the researches carried out in Holland, and also in Canada, that healthy plants growing in close proximity to diseased ones are very liable to become infected.

Control Measures.—As the disease is perpetuated by means of the "seed" it is of the utmost importance that *no seed should be saved from affected plants*. Not only should tubers from dwarfed or distinctly curled plants be rejected for seed purposes, but also those from all plants showing curling of the lower leaves.

In cases where potatoes are specially grown for seed purposes a definite practice should be made of *roguing the crop* each season for leaf-curl. This should be done early (June or July). If this course were followed a higher level of seed-quality would be obtained, and the infection of sound plants from the diseased ones, which, according to recent investigations, is very liable to take place, would be prevented.

In the case of gardens and small holdings it is *not advisable to save any seed from crops on the lighter soils in the drier and warmer parts of the country*. It is well known that potatoes grown in such areas develop leaf-curl extensively, and that even crops from "once grown" Scotch seed (*i.e.*, seed saved the first season after being received from Scotland), showed marked deterioration and reduced yield. In all such localities fresh, northern seed should be obtained each year.

PROFITABLE APPLES FOR MARKET.

THERE is at the present time a heavy demand for fruit trees for planting purposes, and this demand is likely to continue. It is desirable that prospective fruit growers should be well informed as to the profitableness or otherwise of the different varieties available, so that they may place their orders early. The Ministry's Leaflet No. 134, as recently re-written, is therefore here reproduced for the information of those interested. It should be read in conjunction with Leaflets Nos. 283 (Picking and Storing Apples and Pears) and 148 (Planning and Planting a Fruit Plantation).

Trade catalogues offer such a bewildering choice of varieties that the prospective apple grower often finds it difficult to make a satisfactory selection. The difficulty is increased by the fact that the descriptions given are usually confined to the good points. The object of this article is to give an impartial description of both the good and bad qualities of the varieties of apples commonly grown and generally to assist the grower in choosing the varieties most suitable for the purpose he has in view.

Although the varieties selected for fresh planting should be chosen mainly on the lines indicated below, the ultimate effect of the produce of these plantations on the British apple-growing industry as a whole should not be lost sight of. In order that home supplies may be in a favourable position to compete with imported produce it is most important to eliminate the many varieties now grown which are not of first-rate market importance, and to confine the selection to a few standard sorts, so that a considerable bulk of these varieties may be produced at home annually. If standardisation of varieties on these lines be combined with up-to-date methods of grading and marketing, British produce, by reason of its lower cost of production, must eventually replace a large proportion of that imported.

FACTORS INFLUENCING THE CHOICE OF VARIETIES.

(1) *Marketing*.—Where the fruit is disposed of through the wholesale markets, only five or six varieties at most should be chosen; on the other hand, the grower who sells his fruit direct to retail shops, or who has a local connection to maintain, is obliged to make a wider selection, so that the supply

both for dessert and cooking purposes may be continuous throughout the season.

In both cases, early and late varieties should be planted in such proportions that the marketing period is prolonged as much as possible. Provided efficient storage room is available, it is best, to plant the largest possible proportion of late varieties possessing long-keeping qualities, for the prices realised in December, January, and onwards are generally more remunerative than earlier in the season; this course has also the advantage that apple packing during these months ensures wet-weather work for the regular orchard hands.

(2) *Method of Cultivation.*—As a general rule, and provided that the land is suitable, the strong-growing culinary sorts, which form large heads and produce quantity rather than quality are best grown as standards or half-standards; on the other hand, the weaker culinary sorts, which make small trees, and dessert varieties, in which quality is as important as quantity, should be grown as bush trees. With the present condition of the labour market, it is a point in favour of standards or half-standards that the width of planting facilitates horse or mechanical cultivation, while, when in bearing, they produce a larger bulk of fruit at a lower average cost than bush trees. On the other hand, they take a longer time to come into bearing, and the quality, especially of dessert sorts, is not so high. Standards and half-standards planted 30–40 ft. apart allow for intercropping with market-garden crops or bush fruit (gooseberries, currants, etc.) for ten to fifteen years after planting, and with standards the costs of cultivation can then be reduced to the lowest limit by laying the land down to grass.

For cordons only high-quality dessert varieties, giving good results from spur pruning, should be considered. Several culinary varieties, such as Lord Derby or Grenadier, grow well and yield good crops as cordons, but the fruit does not command prices which will repay the cost of the extra attention required.

(3) *Locality and Soils.*—Some of the chief market varieties are definitely known to dislike certain situations and types of soils. For this reason local knowledge should always be followed closely, especially in relation to the power of a variety to resist disease. In some districts certain varieties are very susceptible to apple canker, and unsuitable soil and climatic conditions are usually first manifested in a weakened power of disease resistance. It is useless to plant any variety which is known locally to scab or canker badly.

LIST OF VARIETIES WHICH SUCCEED IN MOST LOCALITIES.

Varieties suitable for Standards.

<i>Culinary.</i>		<i>Dessert.</i>
Bramley's Seedling.	Beauty of Bath,	{ More successful as bush or half- standards.
Newton Wonder.	Worcester Pearmain,	
Annie Elizabeth.	Allington Pippin,	
Lord Derby.		

Varieties suitable for Bush or Half-standards.

<i>Culinary.</i>		<i>Dessert.</i>
Early Victoria.		Mr. Gladstone.
Grenadier.		Beauty of Bath.
Stirling Castle (bush).		James Grieve.
Lord Derby.		Worcester Pearmain.
Lane's Prince Albert (bush)		Rival.
Bramley's Seedling (too strong for bush).		Allington Pippin.
Newton Wonder.		

Varieties suitable for Cordons.

<i>Culinary.</i>		<i>Dessert.</i>
Beauty of Bath.		Allington Pippin.
James Grieve.		King of the Pippins.
Worcester Pearmain.		Cox's Orange Pippin.
Rival.		Egremont Russet.

Varieties not recommended for extensive planting but which do well in some districts:—(They should not be chosen unless they are known to succeed locally, and even then should seldom be planted except for special purposes.)

<i>Culinary.</i>		
Ecklinville Seedling	..	Standard, half-standard, or bush.
Graham's Royal Jubilee	..	Half-standard or bush.
Lord Grosvenor	..	..
Warner's King	..	Standard, half-standard, or bush.
Bismarck	..	Half-standard or bush.
<i>Dessert.</i>		
Cox's Orange Pippin	..	Bush or cordon.
Lady Sudeley	..	" "
King of the Pippins	..	" "

DESCRIPTION OF CHIEF VARIETIES OF APPLES.

ALLINGTON PIPPIN. Oct.—Nov.

A dessert variety following Worcester Pearmain in season. Medium. Lemon yellow flushed and striped with bright red; carries well and is a good regular cropper. A fairly strong grower with a spreading habit. Best grown as bush or cordon on dwarfing stock. Subject to scab, mildew and Woolly Aphis, but usually free from canker. Does not colour well on some soils. More colour is obtained when the centre of the tree is kept open. Is rapidly becoming a standard market variety.

ANNIE ELIZABETH. Dec.—Feb.

A valuable culinary variety. Large, dark green with reddish-brown flush; of good quality and carries well. Is *slow-bearing*, and for this reason is often neglected, but crops well, especially in the west, when once it starts; growth strong and very erect. Suitable as a permanent standard or bush on dwarfing stock. Too slow in bearing for use as a filler. Comparatively free from scab and canker.

BEAUTY OF BATH. Aug.

The best early dessert variety. Small to medium, orange, prettily striped and spotted with red. Quality excellent, but the fruit ripens unevenly and should be picked over several times. Carries well, but must be marketed soon after picking. Inclined to be a shy cropper. Succeeds on either "free" or dwarfing stock, but does best as a bush in the latter. Growth strong, spreading and irregular, often causing trees to be one-sided. Chiefly used as a permanent tree; also suitable as a cordon. Free from canker and scab, and succeeds in most districts.

BISMARCK. Oct.—Dec.

Culinary variety of good quality. Large, heavily flushed with dark crimson. Keeps and carries well and is a good cropper. Suitable for bush and half-standard. Fairly strong grower, moderately upright in growth. Does better in the North than in the South. Inclined to scab and mildew.

BLLENHEIM ORANGE. Nov.—Feb.

A valuable variety of excellent quality for cooking or dessert. Medium to large. Golden yellow with a flushed cheek and russeted. Carries and keeps well. Takes some years to come into bearing, and for this reason is seldom planted now except in grass orchards. A strong grower and forms a spreading tree. Free from disease.

BRAMLEY'S SEEDLING. Nov.—March.

The best late market culinary apple. Large, flat, green, sometimes with a dull red cheek. Excellent quality and commands the highest price of all culinary apples. Carries and keeps well, especially the smaller samples, which, if stored until after Christmas, command a high price. A heavy cropper when trees are formed, but inclined to be biennial in habit. A very strong grower and forms a large, spreading tree. Succeeds best as standard or half-standard on "free" stock, but for bush trees must be grown on dwarfing stock. Very free from scab, canker and other fungoid diseases. Succeeds over a wide range of soils and situations, and is the best variety with which to top-graft unsuitable sorts. This should not be confused with Crimson Bramley, which is inferior.

COX'S ORANGE PIPPIN. Nov.—Jan.

A dessert apple of the best quality. Size medium to small. Round, orange, shaded and striped with dull red. Carries well. A very unreliable cropper and only a moderate grower of somewhat spreading habit. Should be grown either as bush or cordon on dwarfing stocks. Very subject to scab, mildew and canker, especially on heavy, cold soils. Seems to succeed best on gravelly soils. As a commercial variety is a speculation.

EARLY VICTORIA or EMMETH EARLY. Aug.—Sept.

Good quality early cooker. Medium size, green (Codlin type). Bears freely at an early age and is liable to overcrop. Pays to thin when the thinnings are large enough to sell. Growth of medium strength and of upright habit. Requires free stock and naturally forms a good bush, but will also do as half-standard. More suitable as a "filler" than for a permanent tree. Usually free from both apple scab and canker.

ECKLINVILLE SEEDLING. Aug.—Sept.

Early culinary variety of good quality. Large, greenish-yellow covered with large, scattered dots. Soft, and does not keep or carry well if allowed to get too ripe. Prolific and strong, with a more or less upright growth, forming a large standard or bush. The latter should be on a dwarfing stock. Too strong for a filler. Very subject to canker and scab, and for this reason should not be planted unless known to thrive in the district.

ECREMONT RUSSET. Aug.—Sept.

A useful variety for local dessert trade, but liable to be small except from cordons. Golden-yellow covered with russet. Carries well and is a good cropper. Growth moderate, compact and inclined to be upright. Form as very useful bush or cordon, but is no good as a standard.

MR. CLADSTONE. Aug.

Early dessert with season the same as Beauty of Bath. Medium size and highly coloured but quality only fair. Carries fairly well if marketed immediately after picking, but becomes soft and mealy if kept and should, therefore, be sold before fully coloured. Moderately quick bearing and a heavy cropper. Forms a small, spreading tree and should, therefore, be worked on "free" stock. Only suitable for bush or cordon. Often pays better than Beauty of Bath on account of heavy cropping, but its quality is not so good and it should not be grown where Beauty of Bath succeeds. Somewhat subject to scab but usually free from canker. Very useful for local markets.

GRENADIER. Sept.—Oct.

Good quality early cooker, in season immediately after Early Victoria. Large, light green, travels well. Crops in 5-6 years and thereafter bears heavily. Often pays for thinning. Growth moderately strong and inclined to be upright. Usually best as half-standard or bush on "free" stock. On dwarfing stock can be used as a filler. Bears freely on tips if not "headed in."

JAMES GRIEVE. Sept.—Nov.

Dessert variety with season overlapping Worcester Pearmain. Medium, golden-yellow, faintly striped and flushed with red; quality excellent. Travels well in the North but inclined to be soft in the South. Growth strong and inclined to be spreading. Forms a good-sized compact tree. Suitable as a permanent bush tree on a dwarfing stock and also as a cordon. On some soils very subject to canker, scab, and Brown Rot. Colours badly, especially if trees are not thinned well. In the markets it does not sell as well as its quality warrants, probably owing to its lack of colour and softness.

KING OF PIPPINS. Oct.—Dec.

Fair quality dessert variety. Fruit often very small. Golden-yellow with a faint reddish-brown cheek. Carries well. A good cropper. Growth moderate and more or less upright. Seldom planted now on account of the smallness of its fruit and susceptibility to scab and canker.

LADY SUDELEY. Aug.—Sept.

An early dessert variety. Season similar to that of Worcester Pearmain. Good appearance but only of fair quality. Medium, yellow covered with bold crimson stripes. Carries fairly well. Crops rather irregularly. Growth moderate and inclined to be upright. Forms a medium-sized standard but makes a good bush on "free" stock. Usually free from canker but slightly susceptible to scab. Prefers light soils. Sells boldly on the large markets, but is useful for a local trade.

LANE'S PRINCE ALBERT. Oct.—Dec.

Excellent cooker for market, in season after Lord Derby. Large, green, flushed and somewhat striped with red when exposed to sun. Quality and flavour very good. Cooks frothily. Carries well but needs careful handling. Quick bearing and very heavy cropper. Often pays to thin. Must be worked on "free" stock. Growth weak, spreading and crossing. Not suitable for standard or half-standard but only as bush (permanent or filler). Usually free from scab and canker but rather subject to mildew. Succeeds in most localities.

LORD DERBY. Sept.—Nov.

Culinary, very large, green. Season follows Grenadier. Quality good, but does not cook frothily. Crops heavily and carries well. Upright in habit and suitable for permanent tree as standard, half-standard or bush. Sometimes used as a filler. Usually best on "free" stock. Very subject to Brown Rot (Blossom Wilt) on twigs, and on some soils inclined to canker. Should not be planted unless known to thrive locally. Sells especially well in Northern markets. Hard spur pruning essential to keep down Brown Rot canker and to maintain size of fruit.

LORD GROSVENOR. Aug.—Sept.

Culinary variety of good quality with season similar to Grenadier. Large, pale, greenish yellow. Carries fairly well if not too ripe. A very heavy cropper and usually requires thinning. Growth weak and comparatively upright. Grown as a bush on "free" stock and useful as a filler. Subject to canker and scab on many soils.

NEWTON WONDER. Nov.—Feb.

The second best late-keeping cooker. Large, golden-yellow, richly flushed with red. Good quality. Carries and keeps well. Small grades, if kept until after Christmas often sells well for dessert purposes. A good cropper but inclined to be biennial in this respect. Growth strong, and forms a large tree more upright than spreading and not quite so large as Bramley's Seedling. Used for permanent bush, half-standard or standard. Bush trees should be worked on a dwarfing stock. Where the situation or soil is unsuitable it is subject to scab, canker and also bitter pit. On soils overlying chalk it succeeds better than any other variety.

RIVAL. Oct.—Dec.

A dessert variety overlapping in season with Allington Pippin. Medium to large, golden-yellow, flushed with scarlet when exposed to sun. Flavour and quality good. Flesh very firm. Carries well. Not a quick bearer but crops heavily when started. A strong grower forming a compact tree. Best grown as bush tree on dwarfing stock or as a cordon. Usually free from scab but inclined to canker. Does not like heavy soils. Has not been grown for market long enough definitely to prove its worth, but shows great promise.

ROYAL JUBILEE—GRAHAM'S. Oct.—Dec.

Good quality mid-season culinary apple, ranking after Lord Derby in market value. Large. Lemon-yellow, sometimes with a rosy flush. Carries well. Rather slow-bearing but old trees crop heavily. Blossoms late and escapes late frosts. Growth spreading, sturdy and of medium strength. Forms a good-sized bush. Suitable for permanent tree or filler. Free from canker. Its shape makes it rather unsuitable for market purposes and it is little known as a market variety.

STIRLING CASTLE. Sept.—Oct.

Useful culinary apple. Season slightly later than Grenadier. Good quality, medium size, yellowish-green. Carries fairly well but flesh inclined to be soft. Very early bearing and a regular cropper. A very weak grower and should be grown as bush on "free" stock. Used as a filler. Trees over 10 years old are very susceptible to canker, and therefore not suitable for permanent trees.

WARNER'S KING. Oct.—Nov.

An excellent cooker. Large, pale yellow. Carries quite well and is a good cropper. Growth strong, forming a large, upright tree. Bush trees should be on dwarfing stock. Does not like cold soils. Is very susceptible to canker, and for this reason should seldom be planted.

WORCESTER PEARMAN. Sept.—Oct.

Popular and valuable dessert apple of fair quality. Medium to small in size. Orange, often completely flushed into scarlet. Carries well, crops heavily and regularly, and is in great demand. A moderately strong grower of upright habit. Best grown as bush or half-standard on "free" stock. Cankers badly on some soils and is inclined to scab. Always sells well owing to brilliant colour.

QUESTIONS IN PARLIAMENT.

Farms entered on by Agricultural Executive Committees.—In reply to a question by Mr. Hurd, the Parliamentary Secretary to the Ministry stated that the Ministry had in its possession balance sheets showing the financial position with regard to all the farms entered upon by Agricultural Executive Committees and cultivated by those Committees on behalf of the Ministry. It was not considered that there would be any advantage in publishing these accounts or that farmers would be able to draw any reliable conclusions from the figures. The business of the Agricultural Executive Committees was not to show how farms could be worked for profit, but to endeavour to remedy some of the results of long-continued neglect. In many cases this involved heavy outlay before any return would appear. (12th May, 1920.)

Land Cultivation and Increased Wages.—In reply to a question by Sir L. Harmsworth, the Parliamentary Secretary to the Ministry stated that the Ministry had no direct evidence of any land having gone out of cultivation owing to the increased rates of wages, but that the tendency to lay down arable land to grass had, no doubt, been accentuated on that account. (12th May, 1920.)

Meat.—In reply to a question by Mr. J. Davison, it was stated that the estimated quantities of imported and home-grown meat consumed by the civilian population in the United Kingdom for the years stated as under were as follows:—

	<i>Home-killed, Tons.</i>	<i>Imported, Tons.</i>	<i>Total, Tons.</i>
Pre-War years, 1909-13..	1,357,000	750,000	2,107,000
Annual Average—			
1914	1,324,000	689,000	2,013,000
1915	1,356,000	464,000	1,820,000
1916	1,404,000	303,000	1,707,000
1917	1,320,000	232,000	1,552,000
1918	883,000	250,000	1,133,000
1919	975,000	435,000	1,410,000
		(3rd May, 1920.)	

Advances to Tenants of Small Holdings.—In reply to a question by Commander Locker-Lampson, the Parliamentary Secretary to the Ministry stated that the Ministry had informed Councils that owing to the high prices at present ruling for live and dead stock, fertilisers, etc., the amount of capital required to farm an ordinary small holding which, in December, 1918, was stated to be not less than £12 per acre, must now be regarded as not less than £20. Councils were, however, still empowered to guarantee an advance to their small-holding tenants of an amount equal to the amount of capital otherwise possessed by such tenants. (13th May, 1920.)

Prices of Ground Basic Slag, 1920-21.—The Ministry of Agriculture and Fisheries and the Board of Agriculture for Scotland have come to an agreement with the makers of ground basic slag with regard to the maximum prices to be charged for this fertiliser in the season 1920-21. These prices are the maximum net cash prices for ground basic slag in maker's 2-cwt. bags, delivered in minimum lots of 4 tons in railway

truck or free *ex* barge or ship at purchaser's or consumer's railway station or wharf in Great Britain, or, in the case of shipments to Ireland, the Channel Islands or the Isle of Man, carriage paid to station at port of shipment in Great Britain, less a trade discount to manure mixers, agricultural merchants, makers and co-operative societies. The prices are as follows:—

<i>Percentage (calculated in terms of tribasic phosphate of lime) of total Phosphates.</i>		<i>Price per Ton.</i>
12 per cent. and over, but less than 14 per cent.	..	82s.
14 " " " 16 "	..	89s.
16 " " " 18 "	..	96s.
18 " " " 20 "	..	103s.
20 " " " 22 "	..	110s.
22 " " " 24 "	..	112s.
24 " " " 26 "	..	115s.
26 " " " 28 "	..	118s.
28 " " " 30 "	..	121s.
30 " " " 32 "	..	124s.
32 " " " 34 "	..	127s.
34 " " " 36 "	..	131s.
36 " " " 38 "	..	135s.
38 " " " 40 "	..	139s.
40 " " " 42 "	..	143s.
42 " " " 44 "	..	147s.

The above prices apply to England, Scotland and Wales, but not to Ireland, and are maximum prices for sales of ground basic slag for delivery between 1st September, 1920 and the 31st March, 1921. In the case of sales of ground basic slag for delivery during June, July and August, 1920, the maximum prices for all qualities will be less than the prices set out above, in accordance with the following table:—

<i>Period for Delivery.</i>	<i>Reduction in the Maximum Prices set out above.</i>
During June, 1920	4s. per ton.
" July, 1920	3s. "
" August, 1920	2s. "

As the available quantity of the higher grades of basic slag is comparatively small, farmers should be prepared to accept a correspondingly large proportion of the lower grades.

For sales of small quantities made *ex* merchant's store the following additions may be made to the prices charged for 4-ton lots:—

<i>Quantity delivered.</i>	<i>Additional Price.</i>
1 ton and over, but less than 4 tons	.. 15s. per ton.
2 cwt. " " " 1 ton	.. 1s. 6d. per cwt.
1 cwt. " " " 2 cwt.	.. 3s. "
28 lb. " " " 1 cwt.	.. 4s. 6d. "
14 lb. " " " 28 lb.	.. 6s. "

In the case of sales for delivery to consumer's premises *ex* merchant's shop or store, the cost of conveyance, charged at local rates, may be added.

The other conditions of sale remain substantially the same as in the 1919-20 season, with the exception of slight variations in the amounts of the allowances or additional charges authorised. Full particulars are given in a notice which may be obtained post free on application to the General Secretary, Land and Supplies Department, Ministry of Agriculture and Fisheries, 72, Victoria Street, London, S.W.1.

SINCE the date of the list given on p. 193 of the issue of this *Journal* for May last, the following leaflets have been issued in the *Permanent Series* :—

- No. 342.—*The Management of Bulls.*
 „ 343.—*Leaflet on Potato Wart Disease, specially prepared for Children who cultivate School Gardens and for Amateurs in Gardening.* (Formerly issued as Food Production Leaflet No. 28.)
 „ 344.—*Compound Manures.* (Formerly issued as Food Production Leaflet No. 24.)
 „ 345.—*The White Rot Disease of Onion Bulbs.*
 „ 348.—*Redemption of Tithe Rentcharge : The Tithe Act, 1918, Income Tax Liability of Landowner and Titheowner.*

Other Leaflets—

- A.—316/I.—*Abridged List of Publications.*
 A.—318/I.—*A Simple Apparatus for “Gassing” Rats.*

Leaflet No. 61, *Sheep Scab*, has been issued in Gaelic.

In addition the information in the following leaflets has been revised and brought up to date.

- No. 23.—*Potato Disease (“Blight”) and its Prevention.*
 „ 38.—*The Carrot Fly.*
 „ 53.—*The Pear Midge.*
 „ 63.—*Destruction of Charlock.*
 „ 70.—*The Renovation of Neglected Orchards.*
 „ 87.—*The Die-back (Cytospora) Disease of Fruit Trees.*
 „ 92.—*Bunt and Smut in Wheat.*
 „ 120.—*Peach Leaf-curl.*
 „ 129.—*Winter Egg Production.*
 „ 133.—*Powdery Mildew of the Vine.*
 „ 134.—*Profitable Apples for Market.*
 „ 164.—*Potato Leaf-curl.*
 „ 257.—*The International Institute of Agriculture : Its objects and its Publications.*
 „ 315.—*Suggestions and Chart for the General Cropping, Manuring and Cultivation of Allotments.*
 „ 329.—*Redemption of Tithe Rentcharge and Corn Rents : The Tithe Act, 1918.*

The following leaflets have been withdrawn from circulation :—

Permanent Series—

- No. 124.—*The Asparagus Fly.*
 „ 138.—*The Pine Weevil.*

Food Production Series—

- No. 4.—*Jam Making in War Time.*
 „ 52.—*The Distribution of Fruit and Vegetables through the London and Provincial Markets.*

Wart Disease of Potatoes: Free Inspection of Crops.—In order to give farmers greater opportunities of raising clean crops of potatoes and of combating Wart Disease, the Ministry has instituted a system of free inspection of immune varieties and the granting of certificates. In districts of England and Wales regarded by the Ministry as suitable for production of "seed," growers may have their crops inspected on application. This arrangement applies only to growers whose area under potatoes is not less than half an acre. In those cases where, after inspection, the Ministry is satisfied that the stock is pure and the crop generally healthy, a certificate to that effect will be issued free of charge. The object of this inspection is to secure, as far as possible, that pure "seed," true to type, shall be available for planting in 1921, in areas certified as "infected areas" under the Wart Disease of Potatoes Order of 1919. Growers should be aware that under this Order, "seed" of immune varieties can only enter such areas after it has been certificated. Certificates will not be issued unless the authorities are fully satisfied as to the purity of the stock and the general healthiness of the crop. A certificate will assist the grower to sell his seed to a dealer, and will facilitate the entry of such seed into infected areas.

Applications for the inspection of growing crops must be made on forms provided for the purpose, which can be obtained from the Ministry, 72, Victoria Street, London S.W. 1. These forms, duly completed, must be returned to the above address, not later than the 1st July, 1920.

Foot-and-Mouth Disease.—All general restrictions as regards the outbreaks of disease at Frettenham, near Norwich, and Elmley, Isle of Sheppey, which were recorded in the last issue of this *Journal*, were withdrawn as from the 20th May, and 27th May, respectively.

On the 1st June, however, outbreaks of Foot-and-Mouth disease were confirmed at Bowthorpe, near Norwich, and at Broomhill, near Rye, East Sussex. As regards the former of these outbreaks, no developments have occurred, but in the latter, disease was confirmed to exist on the 4th and 5th June on two sets of premises in the immediate vicinity of the premises at Broomhill.

The usual orders prohibiting movement over a wide area were issued on the 1st June. It is to be specially noted that the new outbreak at Bowthorpe unfortunately necessitates the re-imposition of restrictions over a large part of the area freed from restrictions on the 20th May.

Rabies.—No outbreak of Rabies has been confirmed in a home dog since that at Colchester on the 8th April last, but it has been definitely confirmed that Rabies existed in a dog landed from abroad on the 16th December last, which was undergoing quarantine on approved veterinary premises in accordance with the provisions of the Importation of Dogs Orders. The symptoms of the disease did not appear until the dog had completed nearly 4 months' quarantine.

The muzzling restrictions which applied to a small area around Stebbing in Essex were withdrawn as from the 20th May. With this exception the position remains unchanged since the last issue of this *Journal* was published.

Weather Forecasts for Farmers.—The Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1s. and the cost of the telegrams, computed at 1s. per message.

The forecasts are drawn up at 10.30 a.m., 4.0 p.m., and 9.0 p.m. (summer time). Forecasts issued at the morning hour refer to the period covering the afternoon of the day of issue and the morning of the following day. Those issued in the afternoon and evening refer to the whole of the following day. All the forecasts include a Further Outlook of the probable weather beyond the 24-hour period whenever such a Further Outlook can be given.

Notifications will also be issued by telegram when conditions indicate that a spell of several days fair weather is likely, and again when the spell is about to break up. For this service a fee of 6d. is charged for telegraphy. A minimum deposit of 5s. against which the charges may be booked is required.

Applications for regular forecasts (as distinct from Spell of Notifications) should specify the hour of the forecasts desired (or hours if more than one telegram daily is required). They should be sent to the Director, Meteorological Office, Air Ministry, London, W.C.2, and should be accompanied by a cheque or postal order payable to the Meteorological Committee to cover the cost of the telegrams for the period during which the forecasts are to be sent.

Further particulars and printed forms of application may be obtained from the Director of the Meteorological Office.

Applications by telegraph for single forecasts should be addressed to "Weather, London," and the reply should be prepaid.

Fream Memorial Prize.—The Fream Memorial Prize, which is annually awarded by the Ministry to the candidate who obtains the highest marks in the examinations for the National Diploma in Agriculture, has been won this year by Mr. Wm. Caldwell, of Burnhouses, Kilmarnock, a student of the West of Scotland Agricultural College, Glasgow.

The value of the prize this year is about £7 10s., which is to be devoted to the purchase of books.

New Chairman of Agricultural Wages Board.—Sir Ailwyn Fellowes, K.C.V.O., K.B.E., has resigned his position as Chairman of the Central Agricultural Wages Board, and the Minister of Agriculture has appointed Mr. Collingwood Hope, K.C., C.B.E., to succeed him.

May Journal Erratum.—In the issue of this *Journal* for last month, p. 123, line 33, for the word "Coombs" read "Quarters."

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